

# Financial Stability Report

July 2006 | Issue No.20



BANK OF ENGLAND







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The Bank of England has two core purposes — monetary stability and financial stability. The two are connected because serious disruption in the financial system would affect the implementation and effectiveness of monetary policy, while macroeconomic stability helps reduce risks to financial stability.

The Bank's responsibilities for monetary stability are set out in the Bank of England Act 1998. Responsibility for financial stability in the United Kingdom is shared between the tripartite authorities — HM Treasury, the Financial Services Authority (FSA) and the Bank of England. Their roles are set out in a Memorandum of Understanding (MoU).<sup>(1)</sup>

The Bank's responsibility for contributing to the maintenance of the stability of the financial system as a whole derives from its responsibility for setting and implementing monetary policy, its role in respect of payment systems in the United Kingdom and its operational role as banker to the banking system. The Bank aims to bring its expertise in economic analysis and its experience as a participant in financial markets to the assessment and mitigation of risks to the UK financial system including, if necessary, helping to manage and resolve financial crises.

The *Financial Stability Report* aims to identify the major downside risks to the UK financial system and thereby help financial firms, authorities overseas and the wider public in managing and preparing for these risks. The *Report* is produced half-yearly by Bank staff under the guidance of the Bank's Financial Stability Board, whose best collective judgement it represents.

## The Financial Stability Board:

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The *Financial Stability Report* is available in PDF at [www.bankofengland.co.uk](http://www.bankofengland.co.uk).

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<sup>(1)</sup> The tripartite Memorandum of Understanding was revised in March 2006 and is available at [www.bankofengland.co.uk/financialstability/mou.pdf](http://www.bankofengland.co.uk/financialstability/mou.pdf).



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# Overview

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The Bank has made a number of changes since the December 2005 *FSR*, with the aim of providing a clearer, forward-looking synthesis of the key risks to the UK financial system. This is reflected in renaming this publication the *Financial Stability Report*. Section 1 of the *Report* assesses how macroeconomic and financial developments over the past six months have affected risks to the UK financial system, while Section 2 reviews changes in the structure of the system over this period. Section 3 provides the Bank's assessment of key vulnerabilities in the light of those developments. Finally, Section 4 links this risk assessment to the mitigating actions that might be undertaken.

Risk-taking behaviour has swung markedly during the past six months. The early months of the year saw an intensification of risk taking and a corresponding rise in asset prices globally. Since May, risk appetites appear to have diminished somewhat and some asset prices have retraced their path. The profitability of the UK financial system remains high, helping to underpin its resilience to future disturbances. But the risks associated with the key vulnerabilities, while remote, have increased somewhat and remain significant.

## What are the main vulnerabilities?

The Bank focuses on the resilience of the UK financial system as a whole, concentrating on the major UK banks, markets and infrastructures — not because that is where problems are most likely, but because an incident elsewhere is unlikely to have a system-wide impact in the United Kingdom unless it affects them.

Financial markets are inherently volatile and there are always winners and losers within the financial system. But the UK financial system as a whole has been remarkably resilient over recent years in the face of a number of disturbances, including oil and commodity price shocks and, most recently, sharp falls in the prices of some risky assets. Several structural developments have helped to strengthen the system over time, including high profits and capital, continuing improvements in risk management and more sophisticated ways of distributing risk.

The Bank's responsibility is not just to consider the most likely outcome but also to assess major downside risks. By their nature, these risks are likely to be low probability events in the tail of the distribution of possible outcomes. The fact that these risks are unlikely does not mean, however, they should be ignored. The Bank works collaboratively with HM Treasury (HMT) and the Financial Services Authority (FSA) to reduce the probability and impact of these remote risks and to prepare contingency plans for handling them should they crystallise.

The Monetary Policy Committee's (MPC) projections for the UK economy are set out in the May *Inflation Report*. They show steady growth close to trend and inflation around the 2% target. This *Report*, while entirely consistent with that outlook, does not focus on forecasts of the most probable outcome for the financial system. Rather, it identifies underlying vulnerabilities that could, in improbable but plausible circumstances, generate risks to the UK financial system.

In considering these risks, it is helpful to distinguish the underlying sources of vulnerability within the system and the particular events that might trigger them. There are many events that are possible triggers, including avian flu, further oil price rises and heightened geopolitical risk. Whether they would in fact cause a problem for the UK financial system depends on its underlying health and structure.

In this *Report*, six main sources of vulnerability are explored. None of them is new and most are long standing. Although these vulnerabilities are unlikely to crystallise, either individually or in combination, the consequences for the UK financial system if they did could be material.

Their characteristics differ. Some arise from potential mismatches or mispricing in international financial markets. Others are rooted in extended balance sheet positions in parts of the non-financial sector. Others still reflect structural dependencies within the UK financial system. They can be grouped under three headings:

### Vulnerabilities in international financial markets

- **The unusually low premia for bearing risk** presently prevailing across a range of asset markets, notwithstanding recent market movements. In part, this may reflect improved fundamentals and more efficient markets over recent years. But if risk premia rose abruptly, asset prices would fall sharply.
- **Large financial imbalances among the major economies** have continued over the past six months. These may unwind in an orderly fashion; but there is a risk of disorderly unwinding, which could conceivably crystallise credit and market risks.

### Extended non-financial sector balance sheets

- **Rapid releveraging in parts of the corporate sector globally** — for example, among commercial property companies or arising as a result of leveraged buyouts. Against a background of possibly underpriced corporate credit risk, this releveraging could widen and deepen over time.
- **High UK household sector indebtedness** in relation to income. Household balance sheets look strong in aggregate, but there are signs of stress among a minority of households, with personal insolvencies rising sharply.

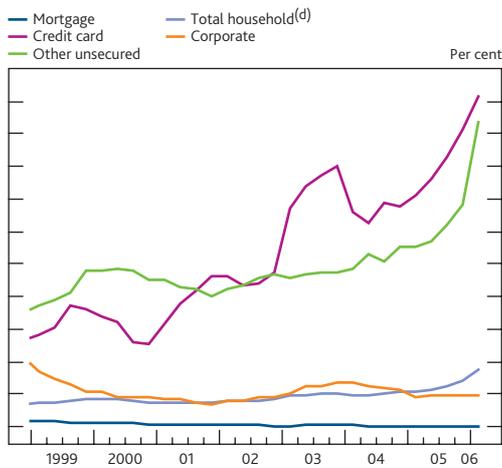
### Structural dependencies within the financial system

- **Rising systemic importance of large complex financial institutions (LCFIs)** given their pivotal position in global capital markets and increasing links with UK banks. Their balance sheets and risk-taking activities also appear to be expanding.
- **Dependence of UK financial institutions on market infrastructures and utilities** for clearing and settling payments and financial transactions, whose contingency plans in the event of any disruption to their services may be inadequately understood and tested by some users.

The following sections of the *Report* assess news over the period relating to these areas of vulnerability (Sections 1 and 2), the scale of risk to the UK financial system (Section 3), and how those risks might be mitigated (Section 4).

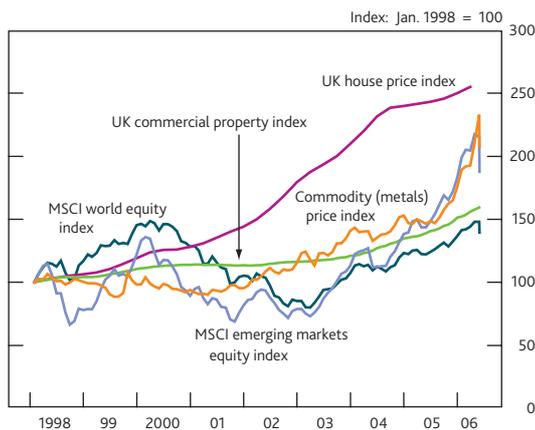
### How have the vulnerabilities changed?

The financial environment over the past six months has swung significantly. The early months of the year were characterised by increased risk taking and a further fall in the price of risk; the latter months by some scaling back of risk taking and a retreat in some asset prices. Even so, most asset prices remain a little higher than in December, though uncertainties around them are also greater.

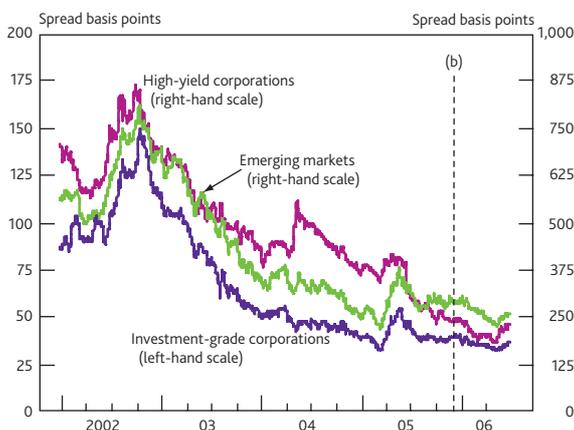
**Chart 1 UK banks' write-offs remain low<sup>(a)(b)(c)</sup>**

Source: Bank of England.

- (a) Data exclude Nationwide.  
 (b) Write-off rates are dependent on specific bank policies, which may vary over time.  
 (c) Write-off rates on lending to UK residents.  
 (d) 'Total household' is the sum of mortgage, credit card and other unsecured.

**Chart 2 Ascent of asset prices**

Sources: Bloomberg, Halifax, Nationwide and Thomson Financial Datastream.

**Chart 3 Descent of risk spreads<sup>(a)</sup>**

Sources: Bloomberg, JPMorgan Chase &amp; Co. and Merrill Lynch.

- (a) Asset swap spreads.  
 (b) December 2005 FSR.

**Low macroeconomic risk helps boost asset prices...**

During the early months of this year, the macroeconomic environment, in the United Kingdom and globally, remained benign. Against that backdrop, the balance sheets of UK households and companies did not look especially stretched in aggregate. This contributed to historically low realised credit losses on UK banks' household and corporate exposures. Although write-off rates on unsecured loans to households have increased sharply, aggregate write-off rates on household and corporate loans are little different from a year ago (Chart 1).

This benign picture was mirrored in rising global asset prices during much of the first quarter — a continuation of the ascent which began in 2002 (Charts 2 and 3) — along the entire risk spectrum. Some investors, such as hedge funds, continued their search for yield. The LCFIs, as key risk intermediaries, continued to create opportunities to meet this demand. And, at the same time, some institutional investors pursued a search for safe assets, sometimes to help hedge their long-term liabilities. That contributed to further rises in the price of both safe and risky assets. Implied volatilities of, and correlations between, asset prices remained at low levels towards the end of the first quarter.

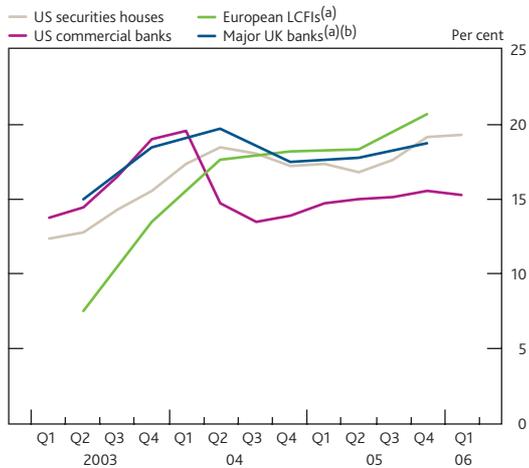
**...and affects the balance of risk-taking incentives at financial firms...**

With realised credit and market risk remaining low up until the end of the first quarter, and with liquidity buoyant, the profits of financial firms, in the United Kingdom and globally, rose in most cases above earlier market expectations. Annual returns on equity for 2005 and 2006 Q1 came in around, or sometimes significantly above, 20% (Chart 4).

These developments appear to have tilted attitudes to risk. Many may have believed that the price of certain assets had become too high and the premium for taking risk too low. But there are business risks associated with acting on that view when others are not; it may not only reduce profitability in the short run, but may also risk losing market share or failing to establish a foothold in a rapidly expanding market. These concerns often seem to have outweighed the risks to balance sheets associated with potentially overpriced assets. As a result, in the early part of this year, there appears to have been an extension of risk-taking activities by financial institutions, including some UK banks.

Against that background, the balance sheets of UK banks and UK-operating LCFIs continued to expand rapidly (Chart 5). In part, this appears to have reflected position-taking in risky and prospectively illiquid instruments including structured credit products, emerging market assets, commodities and commercial property. Financial engineering resulted in a further wave of complex leveraged instruments being created. And the market in leveraged buyouts remained buoyant.

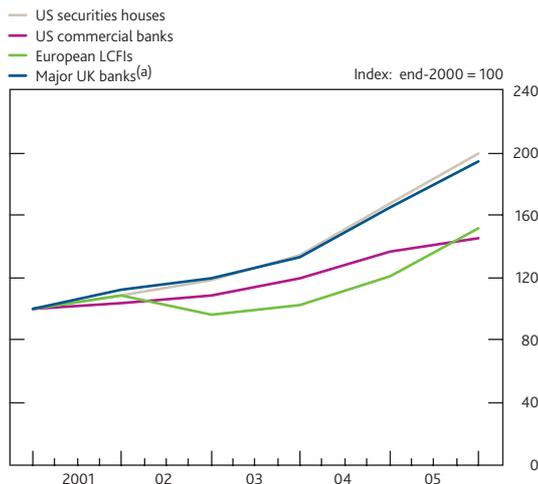
**Chart 4 Return on common equity — high and rising**



Source: Bloomberg.

(a) Data for European LCFIs and major UK banks are half yearly.  
 (b) Data for the major UK banks exclude building societies.

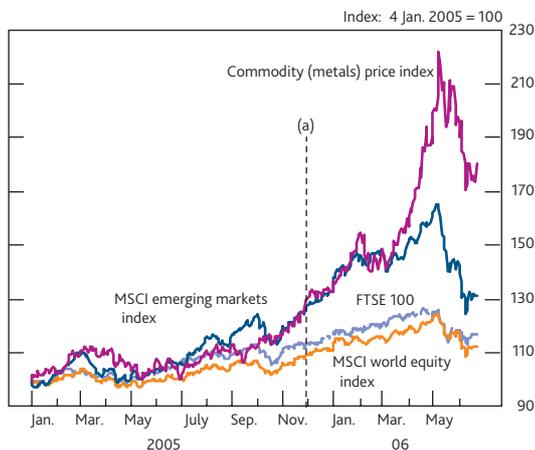
**Chart 5 Balance sheets expand rapidly**



Source: Bloomberg.

(a) Due to changes introduced under IFRS, figures for 2004 and 2005 use the most comparable data possible.

**Chart 6 Asset prices adjust**



Sources: Bloomberg, Thomson Financial Datastream and Bank calculations.

(a) December 2005 FSR.

With market liquidity high, the *ex-post* risk-adjusted return on these instruments remained high and correlations between returns low. So portfolios appeared both high-yielding and well-diversified. For UK banks, the financing of these positions appears to have been met increasingly from wholesale funding markets.

*...but perceived risks have risen more recently, with a knock-on to asset prices.*

More recently, there have been signs of a more cautious pattern of behaviour. Uncertainties about the direction of the macroeconomic environment — both inflation and growth — and macroeconomic policy have increased in some of the major economies. Perhaps in consequence, even relatively modest pieces of macroeconomic news appear to have had a significant effect on financial markets.

The initial effects of the tightening of monetary conditions across the G3 during the first quarter, and the turnaround in global long-term bond yields at around the same time, were muted. Starting in May, however, there has been a sharp and persistent adjustment in the prices of some risky assets, especially those asset classes whose price had risen fastest earlier in the year — equities, commodities and emerging market assets (Chart 6). Implied volatilities of, and correlations between, assets have risen from their abnormally low levels (Chart 7).

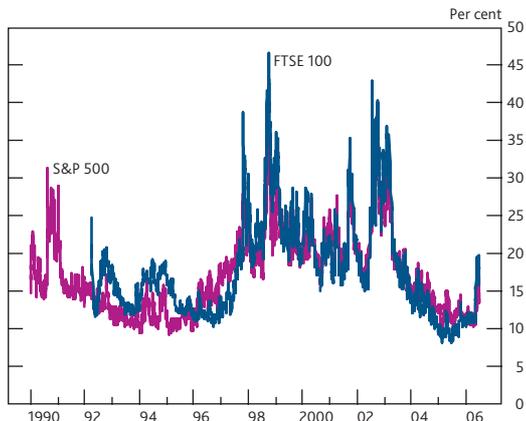
In most respects, this has been a healthy correction. While daily price adjustments have been large, market conditions have remained orderly. Although significantly lower than at the start of May, the level of many asset prices is little different from at the start of the year (Table A). And although higher, volatilities and correlations remain below their levels during previous periods of market turbulence (Chart 7). Market intelligence suggests there has been some paring back of risk-taking activities as higher volatility has persisted. But the central view of market participants remains that this is a limited correction in the price of risk and these developments have not, at least as yet, resulted in a fundamental rethink of medium-term risk strategies by investors or financial intermediaries.

*The key vulnerabilities have worsened slightly...*

Table B provides a summary of how this news over the past six months has affected the Bank's judgement on the six sources of vulnerability discussed in this *Report*. It is broken down into news about the likelihood of them occurring (probability) and the consequences for the UK financial system if they were to do so (impact).

None of the vulnerabilities has altered markedly in terms of probability or impact over the past six months. Perhaps the most significant news relates to low risk premia within

**Chart 7** Implied equity market volatility<sup>(a)</sup> rises



Sources: Bloomberg, CME, Euronext.liffe and Bank calculations.

(a) Three-month (constant maturity) implied volatilities.

**Table A** Risky asset prices rise then fall

	October 2002 to peak <sup>(a)</sup> in 2006	Peak in 2006 to 26 June 2006	Changes since Dec. 2005 FSR
MSCI world equity index <sup>(b)</sup>	+84	-10	+3
MSCI emerging markets equity index <sup>(b)</sup>	+216	-21	+4
Industrial metals price index <sup>(b)</sup>	+258	-19	+39
Investment-grade bond spreads <sup>(c)</sup>	-113	+5	-2
Sub-investment grade bond spreads <sup>(c)</sup>	-535	+32	-29
Emerging market bond spreads <sup>(c)</sup>	-545	+52	-7

Sources: Bloomberg, Goldman Sachs, JPMorgan Chase & Co., Merrill Lynch, Thomson Financial Datastream and Bank calculations.

(a) The peak date is the 11 May 2006 for all series, except for the emerging markets bond index, emerging markets equity index and the world equity index for which 3, 8 and 9 May 2006 are used respectively.

(b) Per cent.

(c) Basis points.

**Table B** Some key vulnerabilities edge up

Vulnerability	Probability <sup>(a)</sup>		Impact <sup>(b)</sup>	
	Significant increase	Slight increase	Significant decrease	Broadly unchanged
Low risk premia	Significant increase	Slight increase	Broadly unchanged	Broadly unchanged
Global imbalances	Significant increase	Slight increase	Broadly unchanged	Broadly unchanged
Global corporate debt	Significant increase	Slight increase	Broadly unchanged	Broadly unchanged
UK household debt	Significant increase	Slight increase	Broadly unchanged	Broadly unchanged
LCFI stress	Significant increase	Slight increase	Significant decrease	Broadly unchanged
Infrastructure disruption	Significant increase	Slight increase	Broadly unchanged	Broadly unchanged

Source: Bank calculations.

(a) Assessed change in the probability of a vulnerability being triggered over the next three years.

(b) Assessed change in the expected impact on major UK banks' balance sheets if a vulnerability is triggered.

financial markets. But with the price of risk having first fallen and then risen, the net effect on the probability of this vulnerability crystallising has been broadly neutral. The impact of such an event has increased over the period, however, as risk exposures appear to have further accumulated across the UK financial system.

Corporate credit risks have increased further as releveraging has continued in some parts of the sector, at the same time as the price of corporate credit has remained low. The potential impact of stress on LCFIs' balance sheets has increased slightly, in line with their stronger links to the UK banking system. The likelihood of household vulnerabilities crystallising has nudged up too, as personal insolvencies have risen sharply. On balance, the risks to UK financial stability from global imbalances and from the possibility of a disruption to market infrastructure are little changed over the past six months.

*...but individually appear manageable for UK banks.*

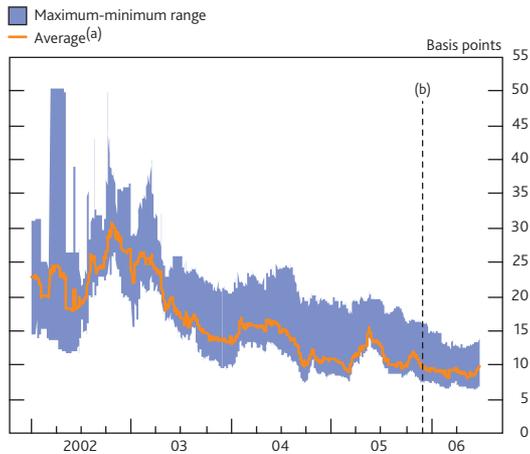
Gauging the potential severity of each of these vulnerabilities, rather than how they have changed, is more problematic. As a contribution towards making those judgements, Bank staff have considered some hypothetical stress scenarios for each of the vulnerabilities and have estimated their potential impact on the UK banking system. The uncertainties around these model-based impact estimates are considerable, for this stress-testing approach is better at capturing some types of risk (such as credit risk) than others (such as liquidity risk). This initial calibration also makes some strong assumptions about the behaviour of financial firms — for example, that they do not adjust their balance sheets following disturbances. Nonetheless, these estimates can be used as a starting point when assessing the prospective scale of each of the main vulnerabilities under conditions of stress.

As Section 3 describes, while the estimates are preliminary, it is clear that the scale of losses associated with the six vulnerabilities under these hypothetical stress scenarios could be significant. For some of the vulnerabilities, the losses in an extreme scenario could come close to absorbing the annual profits of the major UK banks. While losses on this scale would be unlikely to disrupt materially the functioning of the UK financial system as a whole, they could in extreme circumstances affect the reputation and financial standing of some UK institutions.

### What lies ahead?

*Continuing resilience — though future risk-taking behaviour remains uncertain.*

All of the stress scenarios considered are low probability tail events. Far and away the most likely outcome in the near term is that none of the vulnerabilities crystallise. Moreover, even if these vulnerabilities were to crystallise individually, they would

**Chart 8** Major UK banks' default premia remain low

Sources: Bloomberg, Markit and Bank calculations.

(a) Average CDS premia weighted by total assets.  
 (b) December 2005 FSR.

be unlikely to erode to any significant extent the capital base of the UK banking system. This provides strong support for the continuing high resilience of the UK financial system. Market estimates of default probabilities for the major UK banks — as proxied by CDS premia — remain very low and are consistent with that encouraging picture (Chart 8).

The evolution of risk within the system in the period ahead will depend on the future behaviour of financial firms and investors. Recent market volatility has reminded investors and firms of the financial risks they are running. But it remains an open question whether it has changed decisively the perceived balance between financial and business risks. On the one hand, there is some evidence of greater caution about position-taking among some market participants, as the price of risk has risen over the past two months. On the other, the prices of risky assets are little changed from six months ago. Previous recent short-lived episodes of turbulence have, if anything, tended to reinforce perceptions about the stability of the system and have encouraged a return to the risk-seeking environment seen earlier. It is too early to assess whether that pattern will be repeated this time.

#### *Vulnerabilities in combination...*

When gauging the future resilience of the UK financial system, it is important also to consider what would happen if several vulnerabilities crystallised in combination. The *Report* discusses two extreme but plausible scenarios:

- **A sharp turn in the credit cycle:** There are several potential supply-side factors (for example, a marked further rise in oil and other commodity prices) which might prompt such a reassessment of creditworthiness. Were the credit cycle to turn sharply due to these forces — for example, on the scale of the early 1990s recession in the United Kingdom — it would have implications for, in particular, the corporate and household vulnerabilities.
- **A substantial further fall in asset prices:** Despite recent market movements, an abrupt and widespread rise in risk premia and risk-free rates would have important implications for, in particular, the low risk premia, global imbalance, household and corporate vulnerabilities.

#### *...could trigger additional amplification channels...*

In such severe stress situations, certain structural features of the UK and global financial systems, which have grown in importance over the past few years, could amplify market and credit risks. For example, UK and international institutions have increased their exposures to potentially illiquid instruments over recent years. Given their potential illiquidity, a rapid unwind of these positions in the event of losses would tend to depress prices by more than has been the case in the past, particularly if many investors were pursuing similar

strategies in such markets. The adjustment in the prices of some risky assets during May and June illustrate these effects.

On the liabilities side of the balance sheet, UK banks' increasing dependence on wholesale funding has heightened their sensitivity to liquidity developments. Increasing linkages within the UK financial system — for example, arising from interbank and counterparty exposures between UK banks and LCFIs — would also amplify the transmission of risk at a system-wide level. All of these factors would tend to increase correlations between asset returns in a stress scenario, thereby reducing some of the diversification benefits that appeared to exist when correlations were low. Again, recent market developments perhaps illustrate such effects, albeit on a limited scale.

*...highlighting the need for consideration in firms' risk management.*

The severe crystallisation of credit, market and liquidity risk could plainly represent a serious shock to the UK financial system. Such extreme scenarios could be sufficient to more than absorb the annual profits of the UK banking system and therefore cause some material erosion of capital. Although such an outcome is very unlikely, given its potential impact, it merits consideration in financial firms' risk management planning.

## What actions are needed?

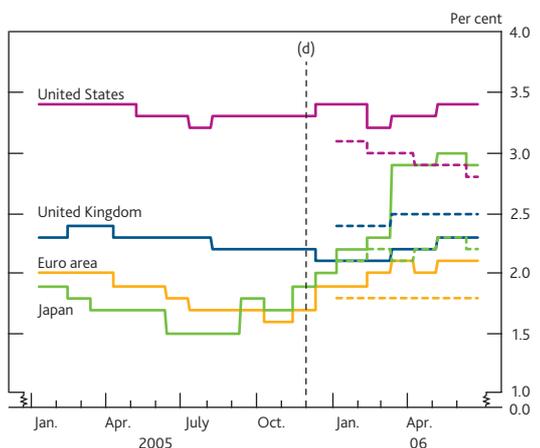
A range of actions might usefully be taken by both the private and official sectors to insure against these risks. These actions would include:

- **Improved risk measurement and management:** There have been significant advances in private sector stress testing over recent years and this is high on the FSA's agenda too. Rather less progress has been made, however, in gauging the combined effects of market, credit and liquidity risks that might materialise in an extreme tail event. Further work is needed on that front. A second priority area is ensuring that extreme, but plausible, macroeconomic stress scenarios inform firms' risk decisions. Macroeconomic stability may have made such stress tests seem less necessary. The public authorities can help ensure that they are carried out and appropriately acted on by firms' management. Publishing the results of these stress tests would further enhance market discipline. A third priority area is liquidity risk management, in particular liquidity risks arising in markets for new and complex instruments. More work is needed on appropriate liquidity standards for firms and liquidity stress tests, both domestically and internationally.

- **Improved system-wide stress testing:** Most firm-level stress testing treats the behaviour of other system participants as fixed. Rising system interconnections, both direct exposures and indirect market linkages, including through complex structured products, make this assumption increasingly unrealistic. Identifying, understanding and calibrating the impact of these interconnections on risks to the system is a priority. This will require further work by both the private sector and the authorities.
- **Improved crisis management capability:** If the potential systemic impact of vulnerabilities is increasing, effective management of such events should they crystallise is an even greater priority. There is a considerable work programme under way, in the United Kingdom and internationally, to improve procedures and information for helping deal with financial or business continuity problems. But further analysis and testing work is needed to develop contingency plans in the event of stress to a major market infrastructure or an LCFI — for example, to ensure effective communication between the private and public sectors and between international authorities.

# 1 Shocks to the UK financial system

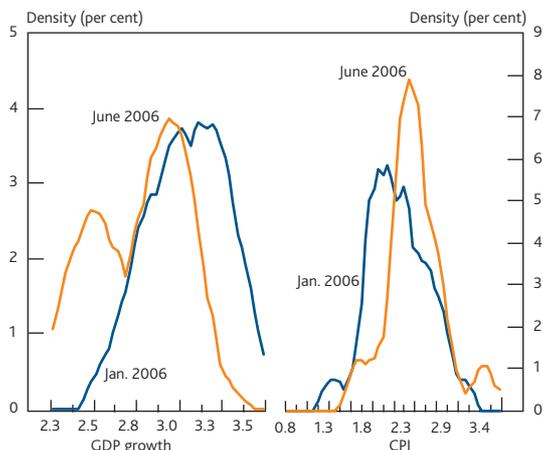
**Chart 1.1** Real GDP growth forecasts, 2006 and 2007<sup>(a)(b)(c)</sup>



Source: Consensus Economics Inc.

- (a) Solid lines are 2006, broken lines are 2007.
- (b) Average annual percentage changes.
- (c) Horizontal axis refers to the month the survey was taken.
- (d) December 2005 FSR.

**Chart 1.2** Distribution of US GDP growth and inflation forecasts for 2007<sup>(a)</sup>



Sources: Consensus Economics Inc. and Bank calculations.

- (a) Densities constructed by fitting kernel functions to individual forecasts provided by Consensus Economics Inc. The area under an estimated density sums to 100%.

Global growth prospects appeared to firm early in the year and asset prices rose further, reflecting a continued search for yield by some investors. Global monetary conditions were tightened and yield curves shifted upwards. As the year has progressed, perceived uncertainty about the global macroeconomic outlook has risen and financial market volatility has increased. Asset price corrections during May and June do not appear to reflect a fundamental change in risk preferences, but may be a signal of heightened market sensitivity in the period ahead. In aggregate, UK household and corporate balance sheets continue to look healthy.

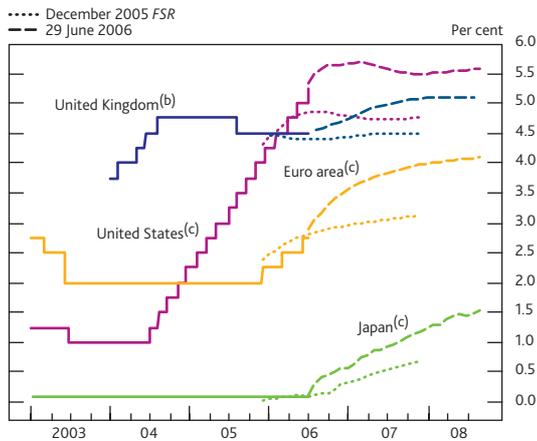
This section discusses developments in the macroeconomy and in global financial markets over the past six months that have affected risks to the UK financial system.

*Uncertainty about the macroeconomic outlook increases...*

The global economic outlook appeared to strengthen in the first quarter of 2006 (Chart 1.1). Steady growth was forecast for 2006 in the United Kingdom and the United States, while expectations for growth rose modestly in the euro area and strongly in Japan. Solid growth in all economies was expected for 2007. But as 2006 has developed, signs of capacity constraints in the United States and rising commodity prices have raised concerns over prospects for inflation. Uncertainty surrounding the medium-term macroeconomic outlook has increased, particularly in the United States (Chart 1.2).

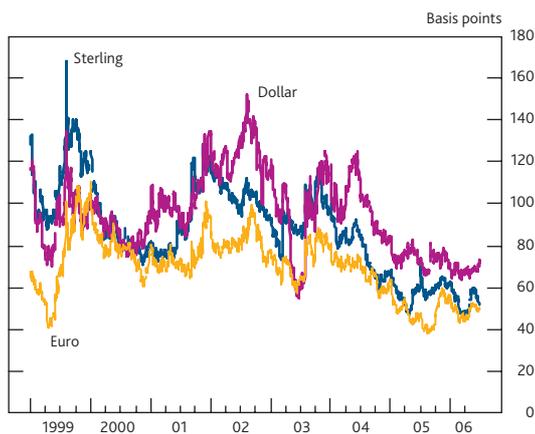
*...and global monetary conditions tighten.*

Over the past six months, monetary conditions have tightened in the major economies. The US Federal Open Market Committee raised its target rate by 25 basis points at each of the five meetings since the December 2005 FSR. The European Central Bank raised interest rates by 25 basis points on three occasions. And in March, the Bank of Japan announced the end of quantitative easing. The Bank of England's Monetary Policy Committee kept rates unchanged over the period. Forward interest rates suggest that market participants expect further increases in policy rates over the next few months (Chart 1.3).

**Chart 1.3 Official and forward interest rates<sup>(a)</sup>**

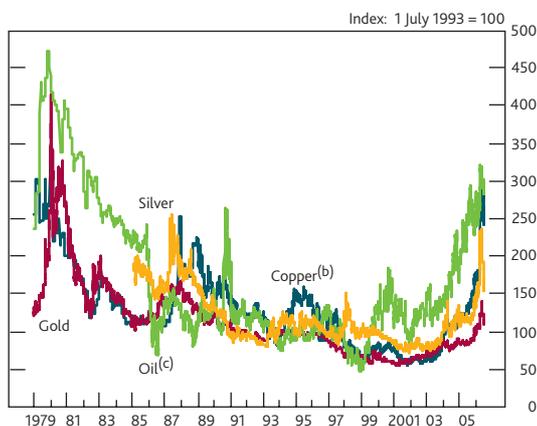
Sources: Bloomberg and Bank of England.

- (a) Solid lines are official interest rates and dotted lines are forward interest rates.  
 (b) Forward rates based on Libor. Forward curves shown in the chart are fifteen-day averages of one-day forward rates. The curves have been adjusted for credit risk.  
 (c) Forward rates based on dollar Libor, Euribor and yen Libor respectively. These curves have not been adjusted for credit risk.

**Chart 1.4 Implied interest rate volatility<sup>(a)</sup>**

Sources: Bloomberg and Bank calculations.

- (a) Twelve-month (constant maturity) implied volatilities.

**Chart 1.5 Real prices of oil and selected metals<sup>(a)</sup>**

Sources: Bloomberg, Global Financial Data, International Financial Statistics, Thomson Financial Datastream and Bank calculations.

- (a) Nominal commodity prices deflated by US CPI.  
 (b) Monthly data until December 1988, daily data thereafter.  
 (c) Monthly data until June 1983, daily data thereafter.

The transition to higher world interest rates may be bumpy.<sup>(1)</sup> The effects of recent interest rate increases are not yet clear and, together with heightened concerns about inflation and growth, this has increased slightly uncertainty about the future path of short-term interest rates. Implied volatilities of short-term interest rates remain low by historical standards, but have edged up a little over the past two months (Chart 1.4). Although the central view of market participants remains that the benign macroeconomic environment will continue, perceived risks around this view appear to have increased.

Earlier in the year, the Bank's market intelligence indicated that some market participants may have been underestimating the uncertainty surrounding macroeconomic policy and macroeconomic outcomes.<sup>(2)</sup> If perceived macroeconomic uncertainties increase, risk premia would be expected to rise and asset prices to fall. Financial market developments during May and June illustrate this process (discussed below).

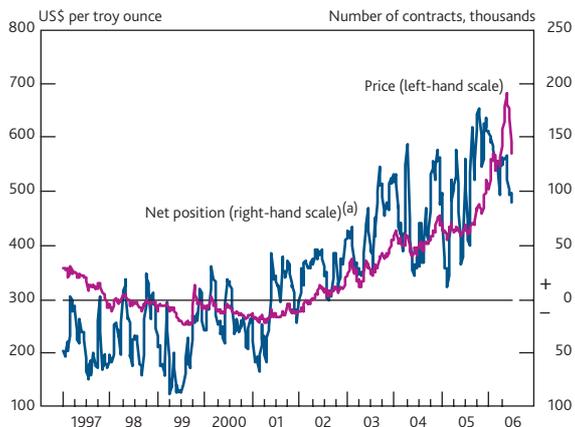
### *Supply shocks could further disturb macroeconomic expectations...*

Global supply shocks, which boost inflationary pressure but constrain growth, could be one possible source of future disturbance to macroeconomic expectations. These include a sudden rise in geopolitical risk (such as rising tensions with Iran), an avian flu pandemic or a further sharp rise in oil and commodity prices. The price of Brent crude has already risen significantly. At the end of April, the price was more than double the level at the end of 2003 and \$18 per barrel higher than at the time of the December 2005 FSR. In real terms, this was its highest level since 1982 (Chart 1.5). Rising oil prices appear to reflect a combination of strengthening world demand and concerns about future supply, including disruptions to production in Nigeria and geopolitical tensions in the Middle East. By end-June, oil prices had fallen by about \$5 per barrel from their peak and are currently around \$70 per barrel. Prices of oil futures suggest that markets expect spot prices to remain above their December levels.

Non-energy commodity prices have also increased sharply. At its peak in May, the Goldman Sachs industrial metals index was 70% higher than at the time of the December 2005 FSR. Gold, silver, and copper prices reached their highest real levels for around two decades (Chart 1.5). As with oil, fundamental factors, such as strong demand for raw materials in emerging economies, particularly China, appear to have pushed up prices. But speculative factors appear also to have been at work (Chart 1.6), facilitated by financial market innovations

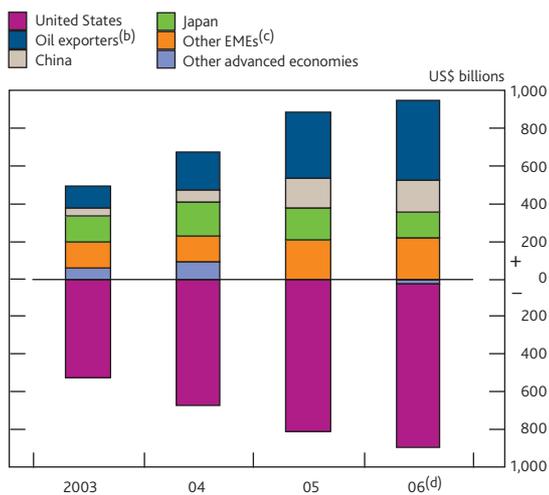
(1) This was discussed in more detail in a speech by the Governor in Scotland on 12 June 2006, available at [www.bankofengland.co.uk/publications/speeches/2006/speech277.pdf](http://www.bankofengland.co.uk/publications/speeches/2006/speech277.pdf).

(2) These points were discussed in more detail in a speech by the Governor in Gateshead on 11 October 2005, available at [www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf](http://www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf), and by Paul Tucker in Chicago on 25 May 2006, available at [www.bankofengland.co.uk/publications/speeches/2006/speech274.pdf](http://www.bankofengland.co.uk/publications/speeches/2006/speech274.pdf).

**Chart 1.6** Speculative positions in gold futures

Sources: Bloomberg, Commodity Futures Trading Commission, Thomson Financial Datastream and Bank calculations.

(a) Difference between long and short non-commercial positions, ie positions unrelated to commercial hedging activities.

**Chart 1.7** Global current account balances<sup>(a)</sup>

Source: IMF.

- (a) Global current account balances do not sum to zero due to errors and omissions.  
 (b) The sum of the ten largest oil exporters in 2004 — Algeria, Iran, Kuwait, Mexico, Nigeria, Norway, Russia, Saudi Arabia, United Arab Emirates and Venezuela.  
 (c) Other EMEs includes the Newly Industrialised Asian economies.  
 (d) IMF forecast, April 2006.

such as exchange-traded commodity funds, commodity indices and structured commodity products. In early May, the Chairman of the London Metal Exchange warned of a bubble developing in the market. Industrial metals prices have since fallen, by around 20% from their peak, but remain around 40% above December levels.

*...and rising oil prices have widened global imbalances.*

The rise in energy prices has contributed to the US current account deficit remaining high, at 6.4% of GDP in 2006 Q1. Deficits in recent years have raised US net foreign liabilities to around 20% of GDP, from a small net asset position 18 years ago. As the counterpart to this, oil exporters' current account surpluses have risen and are now similar in absolute size to those in East Asia (Chart 1.7). As a result, the continued financing of the increasing US net liability position is heavily reliant on the portfolio choices of reserve managers in Asia and a group of oil-exporting countries.

Since the December 2005 *FSR*, macroeconomic adjustments have taken place which could over time facilitate an orderly unwinding of global imbalances. The US dollar exchange rate index has fallen by around 5% and growth and short-term forward interest rate differentials between Europe and Japan and the United States have narrowed. To date, these adjustments in asset prices and growth have been orderly. But with the US deficit remaining wide, there continues to be some risk of a dislocation in prices which might be amplified by certain structural features of financial markets (see Box 5 in Section 2) or by further diversification by reserve managers out of dollar assets. Section 3 considers the potential implications for the UK financial system in the unlikely event of a disorderly unwinding of global imbalances.

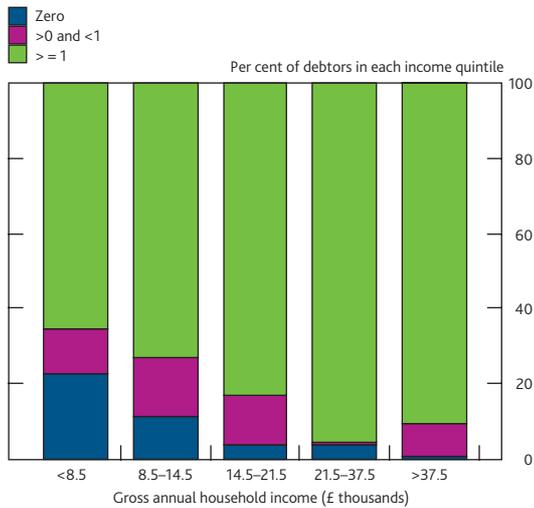
*Household insolvencies have increased sharply...*

Aggregate household balance sheets in the United Kingdom are strong. Although personal indebtedness has increased rapidly, so too has the value of the stock of housing and financial assets, with the result that net household wealth rose by 9% over the year to 2005 Q4. Years of house price increases have created cohorts of mortgage borrowers with houses valued at substantially more than their loans. The ratio of net household wealth to income has increased by 4% over the past year and is a third higher than its trough around ten years ago.

This benign overall picture masks areas of vulnerability, however.<sup>(1)</sup> House price rises have not benefited renters, who typically have lower and more volatile income. Lower income debtors are much more likely to have liabilities that exceed their assets (Chart 1.8) and are particularly exposed to rises in energy prices. Moreover, borrowing by such vulnerable households, including sub-prime mortgage borrowing, has

(1) For more analysis see Barwell, R, May, O and Pezzini, S (2006), 'The distribution of assets, income and liabilities across UK households: results from the 2005 NMG Research survey', *Bank of England Quarterly Bulletin*, Spring, pages 35–44.

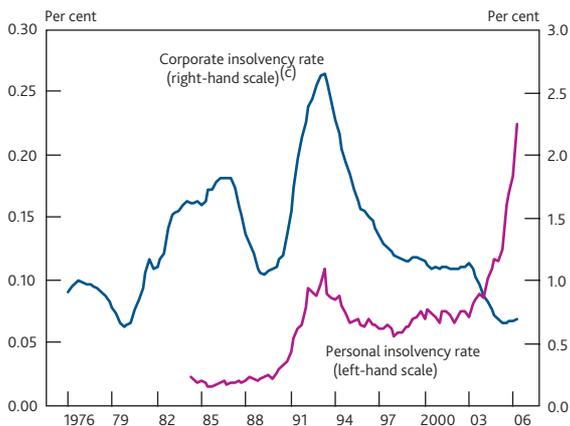
**Chart 1.8** Ratio of assets to liabilities of UK debtor households, September 2005<sup>(a)</sup>



Sources: NMG Research survey and Bank calculations.

(a) Ratio computed for households with any debt who report information on assets, liabilities and income. A ratio of less than one indicates households with more liabilities than assets.

**Chart 1.9** Annualised insolvency rates<sup>(a)(b)</sup>



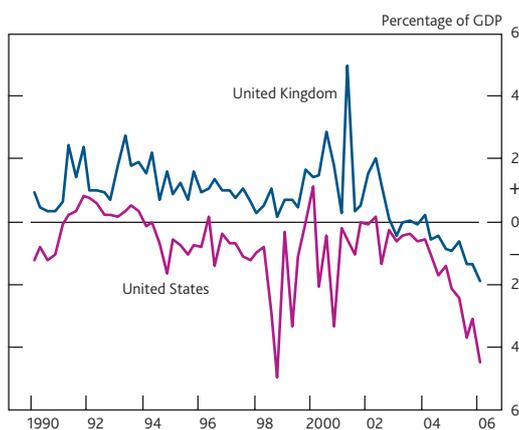
Sources: DTI, ONS and Bank calculations.

(a) 2006 Q1 figures provisional from DTI.

(b) Figures for England and Wales only.

(c) Ratio of annualised insolvencies in the quarter to active registered companies in the last month in that quarter.

**Chart 1.10** PNFCs<sup>(a)</sup> annualised net equity issuance



Sources: Board of Governors of the Federal Reserve System, ONS and Bank of England.

(a) Private non-financial corporations.

grown rapidly in recent years. Rapid house price rises have also increased loan to income ratios for first home buyers. Reflecting these developments, personal insolvency rates have increased sharply in the past few months (Chart 1.9). Excluding the self-employed, insolvency rates are three times higher than their early-1990s peak, though still only about a quarter of the recent average in the United States.

It is possible that there is a growing acceptance of insolvency as a way for debtors to restructure their borrowings. As discussed in the May 2006 *Inflation Report*, the introduction of a new bankruptcy regime may have increased the incentives for bankruptcy in England and Wales, though personal insolvencies have also increased in Scotland and Northern Ireland where there has been no change in regime. Any structural change in behaviour might be amplified if the macroeconomic environment were to change sharply. Section 3 considers the potential losses to the UK financial system in the unlikely event of an increase in stress within the UK household sector.

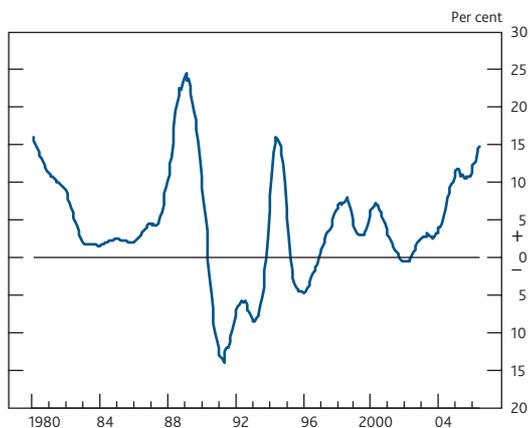
In the United States, where several UK banks also have a large exposure to the household sector, the household saving ratio has been negative since 2005 Q2. Nevertheless, household net worth increased by 10% in the year to 2006 Q1, reflecting rapid equity and house price increases. House price inflation has eased back more recently, with quarterly inflation falling by 1 percentage point in 2006 Q1 (to 2%). Rising house prices have been accompanied by rising mortgage debt (up 15% over the year) and an increasing proportion of new mortgages are at variable rates (around 30%). Both developments increase the US household sector's sensitivity to future interest rate rises.

*...and the corporate credit cycle may also be turning...*

In contrast to households, UK corporate insolvencies in April 2006 remained close to their lowest level for 25 years (Chart 1.9). As a result of strong profits and relatively modest investment expenditure, the UK corporate sector has been a net saver and has accumulated large balances of liquid and financial assets. This unusual behaviour is also occurring in other countries.

Companies in the United Kingdom and United States have been redeeming rather than issuing equity in recent years in net terms (Chart 1.10) and net corporate debt issuance has been low. These factors may have boosted equity valuations of firms and lowered their cost of finance. At the same time, there has been strong corporate borrowing from banks, in particular by UK commercial property companies. Accompanying this, UK commercial property prices have risen sharply, by 15% in the year to May 2006 (Chart 1.11). Taken together, however, corporate leverage ratios, measured at market prices, have fallen further from their peaks in early 2003 as firms have sought to repair their balance sheets (Chart 1.12).

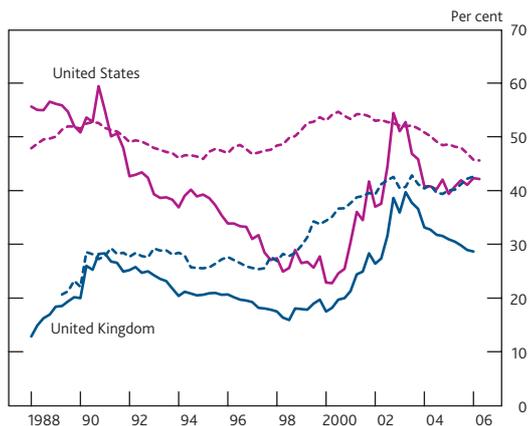
**Chart 1.11** Annual UK commercial property price inflation<sup>(a)</sup>



Sources: Investment Property Databank, Thomson Financial Datastream and Bank calculations.

(a) Interpolated values used prior to 1988.

**Chart 1.12** PNFCs<sup>(a)</sup> capital gearing<sup>(b)</sup>

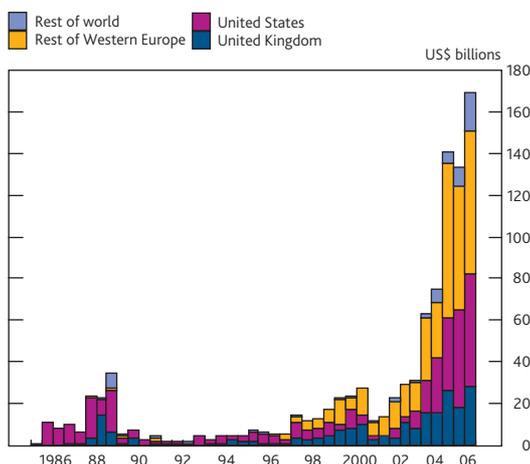


Sources: Board of Governors of the Federal Reserve System, ONS and Bank calculations.

(a) Private non-financial corporations.

(b) Solid lines are gearing ratios at market value, dashed lines at replacement cost.

**Chart 1.13** LBO loan issuance<sup>(a)</sup>



Source: Dealogic.

(a) Data are bi-annual, 2006 H1 includes data up to 26 June 2006.

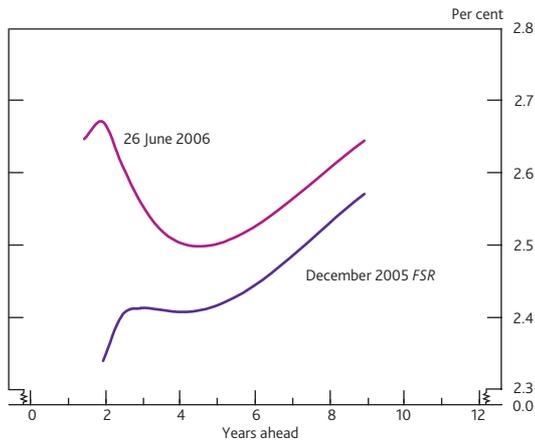
This underlying balance sheet strength has encouraged a wave of leveraged buyouts (LBOs), often involving private equity firms. The rise in LBOs has been particularly strong in the United States and Western Europe, but somewhat more moderate in the United Kingdom (Chart 1.13). LBO purchase prices have risen to record multiples of earnings and competition between lenders has resulted in a continued relaxation of loan covenants. Standard and Poor's estimate that the debt taken on by a typical European LBO rose to more than eight times earnings in 2005, up from seven times in 2004. LBO borrowing, though, remains small relative to the stock of UK corporate debt. Bank staff estimates suggest that, because LBO-funded companies have historically had a higher average probability of default, the direct impact of LBO transactions in 2004 and 2005 may have been to increase the average annual default probability of UK companies by about 0.2 percentage points.

Given current profitability, balance sheet strength and high equity valuations, the low level of corporate default in the United Kingdom is perhaps unsurprising. But some of these supportive trends may not persist. UK and US corporate leverage ratios look less healthy on a replacement cost basis (Chart 1.12). And, as discussed in the December 2005 *FSR*, commercial property prices are higher than might be expected based on rental income and risk-free interest rates. To date, LBOs have affected only a subset of firms. But market contacts suggest the threat of buyouts and the relatively low cost of capital may be encouraging other companies to re-leverage. If these patterns continued, they would increase the vulnerability of global corporate balance sheets to a change in the future financial environment. For example, rising input prices may squeeze future corporate profitability and the cost of capital could rise quickly if investor risk appetite fell. Reflecting these developments, credit rating agencies are anticipating a gradual turning of the corporate credit cycle, with the proportion of credit rating downgrades increasing relative to upgrades in the United States, the United Kingdom and the rest of Europe over recent quarters. Section 3 considers in more detail the potential losses to UK banks in the unlikely event of a sharp deterioration in corporate prospects.

*... as a result of rising risk-free rates.*

One possible source of rising borrowing costs for the household and corporate sectors is a rise in government bond yields — also referred to as 'safe' or 'risk-free' interest rates. Nominal government bond yields at a ten-year maturity have risen by around 70 basis points in the United Kingdom from their trough in January 2006. This has been a global phenomenon, with risk-free rates rising in all major markets and across all maturities.

To some extent, these yield curve shifts appear to reflect upward adjustments in inflation expectations and inflation risk

**Chart 1.14** Market-implied US inflation expectations<sup>(a)</sup>

Source: Bank of England.

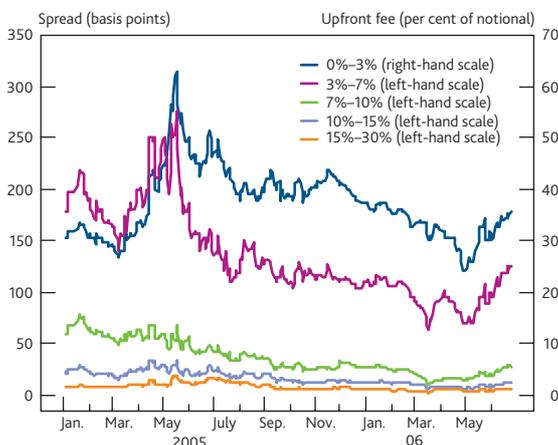
(a) Difference between nominal and inflation-indexed implied forward rates.

**Chart 1.15** Global real long-term interest rates<sup>(a)(b)</sup>

Sources: Bank of England and Bloomberg.

(a) Instantaneous forward rates. The US real interest rate is derived from government bonds which are linked to the CPI. The euro-area real interest rate is derived from nominal government bond yields and CPI inflation swaps. The UK real interest rate is derived from government bonds linked to RPI. CPI and RPI-based measures of real interest rates are not strictly comparable, as the inflation rates are constructed differently.

(b) Nine-year rate for the United States. Ten-year rate for the United Kingdom and the euro area.

**Chart 1.16** CDO tranche spreads and fees<sup>(a)(b)</sup>

Source: JPMorgan Chase &amp; Co.

(a) Losses incurred on the notional principal of the reference North America investment-grade CDS index are allocated from the most junior (0%–3%) tranche through to the more senior tranches as losses increase.

(b) 0%–3% tranche often referred to as 'equity', 3%–7% as 'mezzanine' and others as grades of senior tranches.

premia, particularly over short-term horizons. For example, differences between yields on nominal and inflation-indexed government bond yields in the United States suggest that implied inflation expectations have risen by more than 0.3 percentage points at a two-year horizon in recent months (Chart 1.14). But the greater part of the rise in nominal yields reflects higher global real interest rates (Chart 1.15 and Box 1).

#### *The effects on risky asset prices were initially modest...*

In principle, a rise in the risk-free rates used to discount risky assets should generate a fall in the price of those assets. In practice, for the first part of the year, the prices of risky assets rose further as the search for yield appeared to intensify.<sup>(1)</sup> This was most noticeable in high-risk instruments, but affected the entire risk spectrum to some degree.

Compensation for risk on the speculative, 'equity', tranches of collateralised debt obligations (CDOs) fell sharply until late April (Chart 1.16) — see Box 2 for details on the characteristics of the pay-off structures for tranches of CDOs. At the same time, prices of other high risk assets, such as emerging market bonds and equities (Chart 1.17), speculative-grade corporate bonds and commodities, were rising rapidly. Spreads on speculative-grade corporate bonds and emerging market foreign currency sovereign bonds each fell by around 60 basis points between the December 2005 FSR and early May. By early May, emerging market spreads had fallen to similar levels to investment-grade corporate bonds in late 2002. Emerging market equity prices rose 30% between the December 2005 FSR and early May.

Prices of more moderate risk assets also rose in the early part of the year, although by somewhat less. Spreads on 'mezzanine' tranche CDOs narrowed further. And, global equity prices rose by 14% between the December 2005 FSR and early May. Low risk asset prices also rose. Spreads on senior CDO tranches continued their long decline and investment-grade bond spreads fell slightly.

As risky asset prices were rising strongly, implied volatilities on a number of financial instruments, such as major equity indices, remained low (Chart 1.18) and market liquidity remained strong. Correlations between asset price movements also remained low, giving the impression of risk having been well diversified (Chart 1.19).

#### *...but more recently asset prices have started to correct...*

Over recent months, there have occasionally been indications of an increasing edginess in financial markets. Often seemingly modest pieces of macroeconomic news had a

(1) Low nominal interest rates may encourage some investors and financial institutions to intensify their demand for sources of higher investment returns by purchasing more risky assets. For some financial intermediaries, the 'search for yield' is motivated by having a portion of their liabilities which carry minimum nominal return guarantees. See page 11 of the June 2003 FSR for more details.

### Box 1 The fall and rise in major government bond yields

Risk-free rates in major economies have moved significantly since the December 2005 FSR. Ten-year government bond yields fell sharply in January, but have since rebounded by 70–80 basis points in the United States, the euro area and the United Kingdom. Long-term yields have moved little since the middle of May, as some risky asset prices have fallen.

The sharp fall in long-term yields in January 2006 continued the downward drift in global real rates under way since the end of 2003.<sup>(1)</sup> Market contacts suggest that the sharp fall in long-term real yields in the United Kingdom was given further impetus by an imbalance between the supply of long-dated UK government bonds and the demand for these instruments by pension funds and insurance companies seeking to match a higher proportion of their bond-like liabilities. Their attempts to ‘search for safety’ by hedging their liabilities in this way may have created a feedback effect by lowering the discount rates used to value the liabilities. Higher valuation of liabilities then resulted in further demand for long-dated bonds for hedging purposes. These dynamics may have contributed to the yield on 50-year RPI-indexed bonds falling to an intraday low of 0.4% on 17 January.

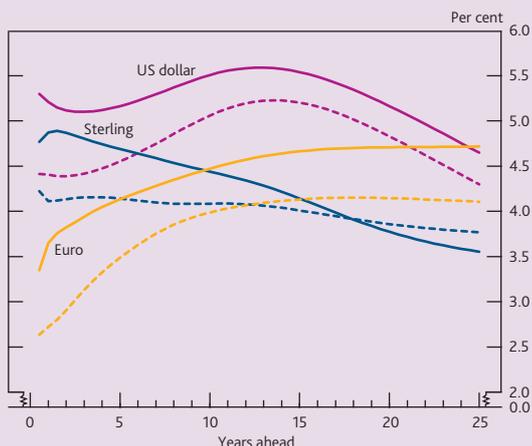
These market microstructure effects seem to have persisted at the very long end of the yield curve in the United Kingdom. Chart A shows that the increases in long-term government yields reflect higher forward rates at all future horizons in the United States and the euro area. In the United Kingdom, however, forward rates are higher only at short and medium-term horizons; beyond a 20-year maturity they have fallen further since the December 2005 FSR.

Government bond yields bounced back across the major economies between January and May. The decomposition of changes over this period in Chart B shows that while implied inflation expectations nudged up during this period — for example, by about 15 basis points at the nine-year maturity in the United States — they do not account for most of the rise in yields.

Most of the increase appears to reflect higher global real rates. It is difficult to identify precisely the causes of this rise. In part, it may simply represent a correction of a previous misalignment. Analysis of changes in international real forward rates suggests an increase in the explanatory power of a common factor in recent months. So a significant proportion of the increase appears to be a common global effect. In general, long-term real rates should be determined by the balance of savings and investment. So one possibility, given

the strength of corporate balance sheets across the major economies, is that market participants are expecting increased future investment. A second hypothesis is that market participants have increased their expectations of the neutral rate required to deliver stable inflation in the longer run, following recent monetary tightening.<sup>(2)</sup>

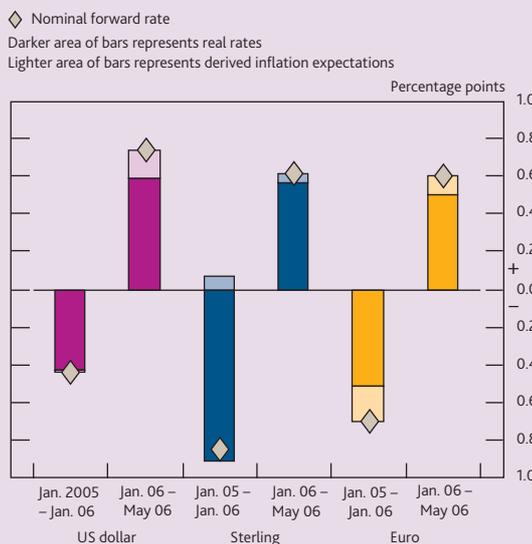
Chart A International nominal forward rates<sup>(a)(b)</sup>



Source: Bank of England.

(a) Instantaneous forward rates derived from the Bank’s government liability curve.  
(b) Solid lines at 26 June 2006, dashed lines at December 2005 FSR.

Chart B Changes in nine-year forward rates<sup>(a)</sup>



Sources: Bank of England and Bloomberg.

(a) Real component of euro rates implied by nominal government bond yields less inflation swap rates. Sterling and dollar real rates derived from the Bank’s government liability curves.

(1) Possible explanations for the decline in global real interest rates have been discussed in a number of *Bank of England Quarterly Bulletins*. See, for example, page 6 of the Spring 2006 *Quarterly Bulletin*.

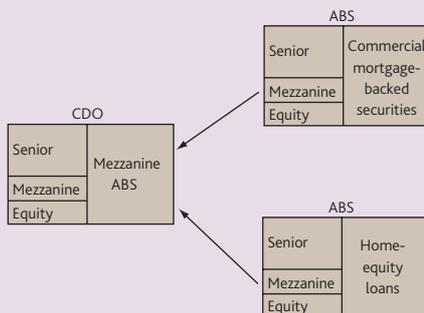
(2) This is discussed in the *Bank of England Quarterly Bulletin*, Summer 2006, which highlights the increased correlation between short-term nominal and long-term real rates in recent years.

## Box 2 Collateralised debt obligations and risk

Collateralised debt obligations (CDOs) are securities issued in tranches of varying seniority backed by a portfolio of credit instruments such as bonds or loans. The first few per cent of credit losses on the underlying portfolio are allocated to the 'equity' tranche, the next few per cent to the 'mezzanine' tranche and any further losses to more senior tranches.

The market for CDOs has grown rapidly in recent years, with global funds invested in them now close to US\$ 1 trillion — a figure comparable to funds under management with hedge funds.<sup>(1)</sup> Recently, CDOs backed by portfolios of asset-backed securities (ABS), notably based on home-equity loans and commercial mortgages, have become popular. These securities take risk tranches (often a mix of high risk mezzanine and lower risk senior tranches) from several ABS and repackage these risks into new securities of different seniority (Chart A). US issuance of CDOs of ABS more than doubled in 2005 to around US\$ 120 billion.

Chart A CDO of ABS



In general, equity tranches of CDOs have high expected losses and their value is very sensitive to changes in default prospects. Reflecting this, equity tranches pay high yields. Investors are compensated for the higher risk of equity tranches by receiving an upfront fee plus a fixed annual spread. They have been popular with hedge funds and other investors searching for yield in an environment of low risk-free interest rates. They are also often held by originating banks or the CDO managers (increasingly hedge funds themselves), which take the first-loss position to demonstrate their commitment to monitor the credit quality of the underlying portfolio.

Mezzanine tranches usually have investment-grade credit ratings and are attractive to institutional investors who cannot invest in sub-investment grade claims. But their pay-offs are highly non-linear. For example, investors in a 3%–7% mezzanine tranche suffer no loss of principal if the loss rate on the portfolio of underlying securities is less than 3%, but lose all of their principal if it is more than 7%. The most senior

tranches are closest to risk-free securities because they have only a remote possibility of losses. These are often held by monoline insurers with AAA ratings.

Financial engineering of this type does not alter the financial sector's aggregate credit exposure to the non-financial sector. It does, however, alter the distribution of risk within the financial sector by concentrating it in some securities and reducing it in others. This can improve systemic stability if risk is held by those with the greatest capacity to absorb losses.

One possible benefit to systemic stability of CDOs of ABS comes from diversification because they contain a wider portfolio of underlying credits. The ABS in the CDOs may be related to very different types of exposures across both the household and corporate sectors. This means that holders of CDOs of ABS have only a modest vulnerability to idiosyncratic defaults that would affect just a few of the ABS. But investors in these securities are vulnerable to macroeconomic risks that affect many of the underlying ABS at the same time.<sup>(2)</sup>

Systemic stability also relies on investors knowing what risks they are bearing. The very complexity of these instruments makes it difficult for investors to determine precisely how exposed they are to particular risk factors. The potential losses, and hence the market values, of CDO tranches are dependent on default correlations within the existing portfolio, which are difficult to calibrate.

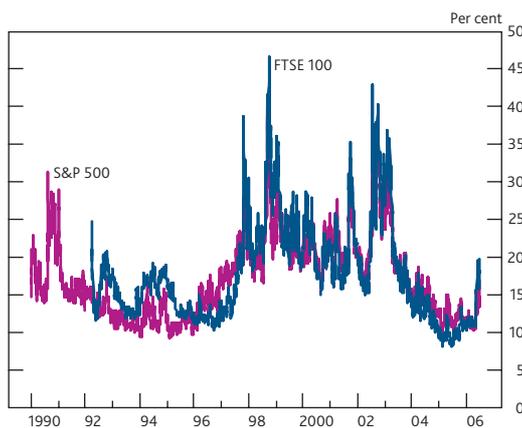
Modelling difficulties can also lead to errors in hedging, so traders can find themselves with residual exposures that they thought they had hedged. In such situations, they may wish to reduce the residual exposure if credit losses rise. But with the liquidity of CDO markets still developing, especially for some of the more complex instruments, a shortage of secondary market liquidity could potentially amplify price movements in the event of a shock.

(1) The market is even larger when synthetic CDO investments are included, but the data on these are incomplete.

(2) See also Belsham, T, Vause, N and Wells, S (2005), 'Credit correlation: interpretation and risks', Bank of England *Financial Stability Review*, December, pages 103–15.

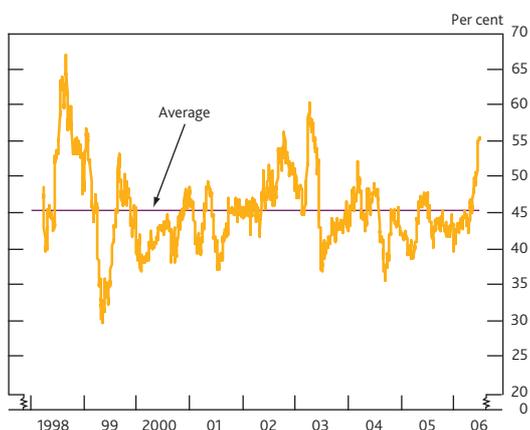
**Chart 1.17** UK and international equity indices

Sources: Bloomberg and Bank calculations.

**Chart 1.18** Implied equity market volatility<sup>(a)</sup>

Sources: Bloomberg, CME, Euronext.liffe and Bank calculations.

(a) Three-month (constant maturity) implied volatilities.

**Chart 1.19** Common component in asset prices<sup>(a)</sup>

Sources: Bloomberg and Bank calculations.

(a) Proportion of variation in global equities, emerging market equities, commodities and ten-year US Treasury yields explained by a common component over a three-month rolling window.

substantial impact on asset prices. In February, Iceland's credit rating was downgraded and the Icelandic krona subsequently depreciated by 15%. Because holding Icelandic bonds was a prominent example of a high-yield strategy where risk had materialised, it prompted a reassessment of investment in countries with similar structural characteristics, such as Hungary and New Zealand (Chart 1.20). There was also a sell-off in Middle Eastern stock markets. Major developed capital markets were, however, largely immune to these developments.

Starting in May, there has been a more sustained and wider-ranging correction in risky asset prices. The price adjustment was felt most strongly in asset classes that had risen most steeply over the preceding period — hence 'correction' — and was focused among assets towards the riskier end of the spectrum (Table 1.A). Emerging market and sub-investment grade spreads have risen on average by around 50 basis points and 30 basis points respectively from their low points. And spreads for some individual borrowers have increased by much more than these averages — for example, by 150 basis points for Turkish sovereign bonds since end-April. Spreads on equity and mezzanine CDO tranches have retraced most of their falls since the December 2005 FSR. Global equities have fallen by about 10% from their peak during early May and industrial metals prices are around 20% lower. Low-risk assets adjusted the least, with investment-grade corporate bond spreads rising by 5 basis points.

In line with these movements, market volatility and correlations have risen. The 30-day historical volatility of the FTSE 100 has risen from 10% to 20% and the distribution of daily returns has been much wider since the beginning of May (Chart 1.21). As a result, the price of protection against equity price variability — as measured by implied volatility — has risen sharply (Chart 1.18). Correlations between asset price movements have risen sharply to levels last seen around the time of the invasion of Iraq in 2003 (Chart 1.19).

*... though assets remain richly priced and risk expectations low.*

Looking over a longer period, asset prices across a wide range of asset classes — bonds, equities, commodities, housing, and commercial property — appear to remain high relative to their expected future income streams, at least based on historical trends. For example, notwithstanding recent falls, equity prices are still similar to levels at the start of the year and are substantially higher than their trough in 2002 (Table 1.A). And emerging market bond spreads and sub-investment grade corporate bond spreads are lower than at the time of the December 2005 FSR. While volatilities and correlations between these assets increased sharply during May and June, they remain well below previous episodes of market turbulence. Measures of market liquidity suggest this remains plentiful too.

**Chart 1.20** High-yield exchange rates<sup>(a)</sup>

Sources: Bloomberg and Bank calculations.

(a) US dollars per currency unit.

**Table 1.A** Price changes of risky assets

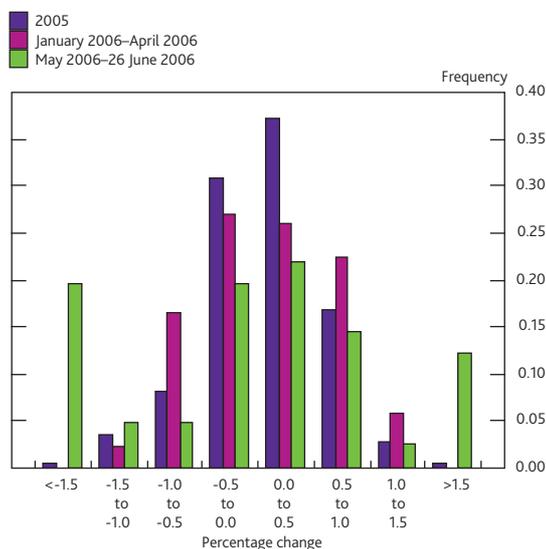
	October 2002 to peak <sup>(a)</sup> in 2006	Peak in 2006 to 26 June 2006	Changes since Dec. 2005 FSR
MSCI world equity index <sup>(b)</sup>	+84	-10	+3
MSCI emerging markets equity index <sup>(b)</sup>	+216	-21	+4
Industrial metals price index <sup>(b)</sup>	+258	-19	+39
Investment-grade bond spreads <sup>(c)</sup>	-113	+5	-2
Sub-investment grade bond spreads <sup>(c)</sup>	-535	+32	-29
Emerging market bond spreads <sup>(c)</sup>	-545	+52	-7

Sources: Bloomberg, Goldman Sachs, JPMorgan Chase &amp; Co., Merrill Lynch, Thomson Financial Datastream and Bank calculations.

(a) The peak date is the 11 May 2006 for all series, except for the emerging markets bond index, emerging markets equity index and the world equity index for which 3, 8 and 9 May 2006 are used respectively.

(b) Per cent.

(c) Basis points.

**Chart 1.21** Daily changes in FTSE 100

Sources: Bloomberg and Bank calculations.

And recent asset price movements, although larger than in the immediate past, have not resulted in market disorder. The Bank's market intelligence indicates that market events during May and June may have checked risk appetite, at least among some institutions. Private sector surveys of investor sentiment have reached a similar conclusion.<sup>(1)</sup> But taken together, this evidence does not suggest a fundamental rethink of risk preferences and risk strategies by financial markets has taken place.

Recent events, and financial markets' response to them, may, however, be important as a signal of the potential sensitivity of asset prices and financial positions to future disturbances. Current levels of asset prices appear still to be based on optimistic expectations about future risks and uncertainties, including about the macroeconomic outlook. These expectations, while less strongly held than six months ago, are still the central view of the majority. Recent market movements illustrate the potential consequences of these expectations changing quickly. And as Section 3 discusses, in the event of a sharp fall in asset prices, some of the underlying vulnerabilities in the balance sheets of corporates, households and, ultimately, financial institutions could be exposed.

(1) For example, see the survey in Goldman Sachs' *Portfolio Strategy*, 1 June 2006.

## 2 Structure of the UK financial system

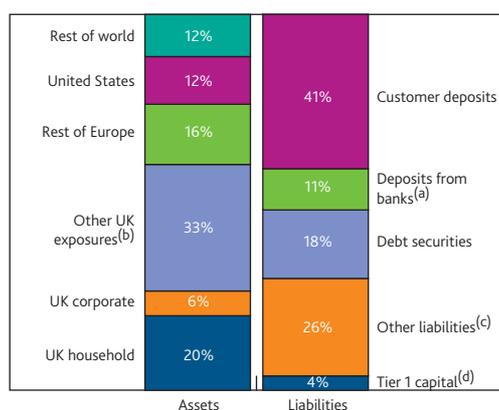
Growth in UK bank lending to the UK household sector has continued to slow in parallel with a sharp increase in write-off rates on unsecured lending. But growth in lending to the corporate sector remains strong, in particular to UK commercial property companies. The major UK banks are also continuing to increase their participation in the syndicated loan market and are increasingly reliant on wholesale sources of funding. This leaves them more vulnerable to falls in market liquidity. They maintain large exposures to large complex financial institutions (LCFIs), whose profitability has increased because of record trading revenues. Competitive pressures to increase revenues may, however, be outweighing concerns about balance sheet risks across the financial sector.

This section discusses recent developments in the structural characteristics of the UK financial system — in particular, among the UK banks — and how they relate to the macroeconomic and capital market developments discussed in Section 1.

### *Structure of the major UK banks' balance sheet.*

Chart 2.1 shows a stylised representation of the major UK banks' aggregate balance sheet at the end of 2005.<sup>(1)</sup> UK banks maintain a large exposure to domestic credit and interest rate risk through their lending to the UK household and corporate sectors. This accounted for just over a quarter of total assets at end-2005. Exposures to overseas borrowers represented two fifths of the major UK banks' total assets. The rest of Europe and the United States account for the majority of the major UK banks' foreign assets, though claims on emerging market economies (EMEs) have been rising and accounted for over 17% of total foreign assets at the end of 2005.<sup>(2)</sup>

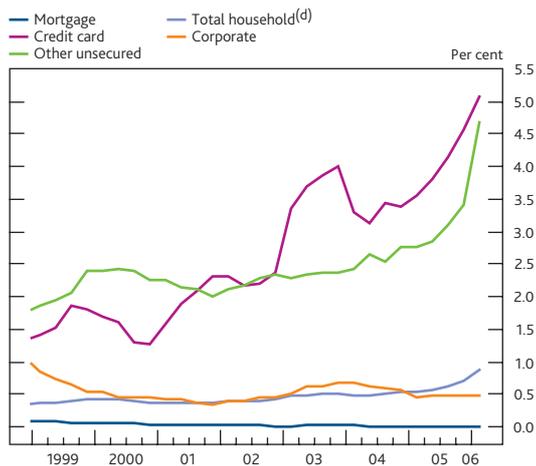
**Chart 2.1** The major UK banks' aggregate balance sheet as at end-2005



Sources: Bank of England, Financial Services Authority (FSA) regulatory returns and published accounts.

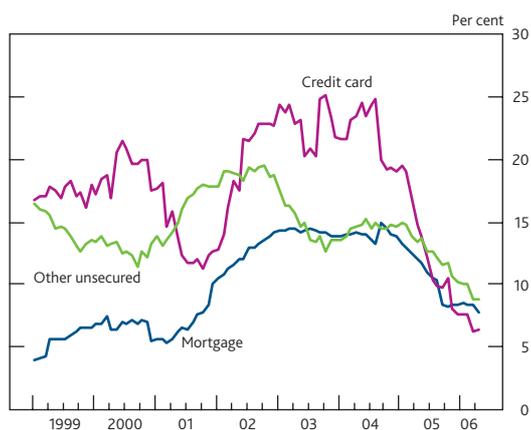
- (a) Deposits from banks include borrowing from major UK banks.  
 (b) Other UK exposures include (among other items) loans to UK-resident banks and other financial corporations and holdings of UK government debt.  
 (c) Other liabilities include Tier 2 capital, short positions, insurance liabilities and derivative contracts with negative marked-to-market value.  
 (d) Assets are not risk weighted. As a percentage of risk-weighted assets, Tier 1 capital is 8%.

- (1) Membership of the major UK banks group is based on the provision of customer services in the United Kingdom, regardless of the country of ownership. The following financial groups, in alphabetical order, are currently members: Alliance & Leicester, Banco Santander, Barclays, Bradford & Bingley, HBOS, HSBC, Lloyds TSB, Nationwide, Northern Rock and RBS.  
 (2) Claims are calculated on an ultimate risk basis to ensure that exposures are allocated to the country where the credit risk ultimately lies. See Box 6 on page 34 of the June 2005 FSR.

**Chart 2.2** Major UK banks' annual write-off rates<sup>(a)(b)(c)</sup>

Source: Bank of England.

- (a) Data exclude Nationwide.  
 (b) Write-off rates are dependent on specific bank policies, which may vary over time.  
 (c) Write-off rates on lending to UK residents.  
 (d) 'Total household' is the sum of mortgage, credit card and other unsecured.

**Chart 2.3** Major UK banks' annual growth in lending to UK households<sup>(a)(b)</sup>

Source: Bank of England.

- (a) Data exclude Nationwide.  
 (b) Data are for individuals; unincorporated businesses excluded.

The major UK banks are further exposed to counterparty credit and interest rate risk through their lending to each other and to other financial institutions, most notably the non-UK LCFIs.<sup>(1)</sup> They are also exposed to market and liquidity risk through their wholesale funding and trading activities, where the latter are concentrated among the internationally active banks. Through all of these activities, the major UK banks also have an indirect exposure to LCFIs, who act as key intermediaries in domestic and global capital markets. Additional risks to the major UK banks' balance sheets arise through their common dependence on key market infrastructures.

#### *Growth in UK banks' unsecured lending continues to slow...*

The major UK banks' exposures to UK households are predominantly secured on residential property. At the end of March 2006, mortgage lending accounted for 87% of the major UK banks' stock of lending to UK households. UK banks' write-off rates on mortgage lending are much lower than those on unsecured lending and remained at extremely low levels during 2005 (Chart 2.2). The annual growth rate of mortgage lending slowed during the fourth quarter of 2004 and the first half of 2005, but has since levelled off; it was just under 8% in the year to April 2006 (Chart 2.3). According to market contacts, some lenders have increased their maximum loan to value (LTV) ratios, although average ratios on new lending remain considerably lower than during the early 1990s. And while the UK sub-prime mortgage market has grown rapidly in recent years, the exposure of the major UK banks to this sector remains small.

As Section 1 discussed, rising UK household indebtedness is creating pockets of vulnerability. During 2005, there was a sharp rise in annual write-off rates on unsecured lending by UK banks, with the annual write-off rate on credit cards reaching 5.1% in 2006 Q1 (Chart 2.2). Partly reflecting a possible change in attitudes towards bankruptcy, this may have raised uncertainties among banks about household credit risk, particularly for unsecured lending. Contacts report that the major UK banks have tightened their lending criteria further over the past six months. Interest rate spreads on some credit cards have been widening and banks have been restricting credit availability for some borrowers, including the highly indebted. Reflecting this, the annual growth rate of unsecured lending to households continued to slow during 2005 Q4 and 2006 Q1; credit card lending experienced the sharpest deceleration, to a twelve-month growth rate of 6.4% in April 2006 (Chart 2.3).

(1) LCFIs include the world's largest banks, securities houses and other financial intermediaries that carry out a diverse and complex range of activities in major financial centres. The group of LCFIs is identified currently as: ABN Amro, Bank of America, Barclays, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JPMorgan Chase & Co., Lehman Brothers, Merrill Lynch, Morgan Stanley, RBS, Société Générale and UBS.

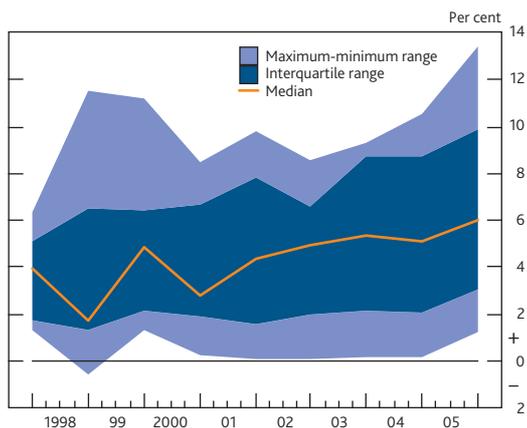
**Chart 2.4** Major UK banks' annual growth in lending to UK non-financial companies<sup>(a)</sup>



Source: Bank of England.

- (a) Data exclude Nationwide.  
 (b) Total lending to non-financial companies including lending to real estate companies.

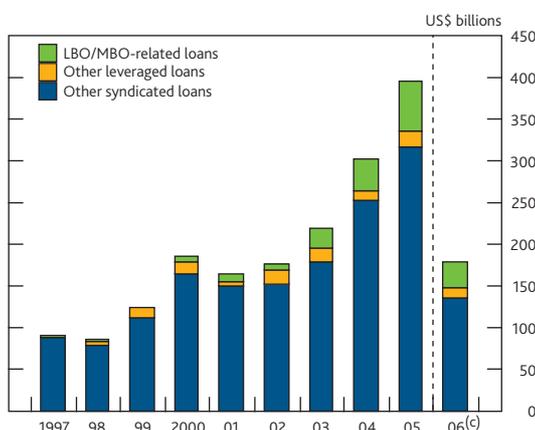
**Chart 2.5** Major UK banks' dealing profits as a percentage of operating income<sup>(a)(b)</sup>



Sources: Published accounts and Bank calculations.

- (a) Data are for those major UK banks that report dealing profits.  
 (b) Due to changes introduced under International Financial Reporting Standards (IFRS), figures for 2004 and 2005 use the most comparable data possible.

**Chart 2.6** Major UK banks' participation as lead arranger in global syndicated lending<sup>(a)(b)</sup>



Sources: Dealogic and Bank calculations.

- (a) Includes cancelled loans, but excludes amendments and unsigned loans.  
 (b) Where the actual proportions provided by each syndicate member are unknown, loan amounts have been split equally among participating banks.  
 (c) 2006 figures are year-to-date.

*...while UK commercial property lending remains strong...*

With corporate insolvencies remaining very low, annual write-off rates by UK banks on corporate loans were only 0.5% in 2006 Q1 (Chart 2.2). But as noted in Section 1, there are signs that the corporate credit cycle could be turning. Some of the major UK banks warned in their annual accounts that impairment charges, which had been particularly low in 2005, could rise in 2006. Despite slowing from an average annual growth rate of 15% in 2005, major UK banks' lending to domestic non-financial companies is still strong, at an annual rate of just under 13% in March 2006 (Chart 2.4).

The commercial property sector has been a source of substantial credit losses for UK banks in the past, with write-offs tending to be more cyclical than on other corporate exposures. Exposures to UK commercial property companies<sup>(1)</sup> accounted for only 2.4% of the major UK banks' total assets at the end of 2005, but these exposures are highly concentrated among lenders. Despite having recently slowed, the annual growth rate of lending by the major UK banks to the UK commercial property sector remains strong, at around 13% in March 2006 (Chart 2.4). Moreover, for the second consecutive year, margins and interest cover on property lending have fallen while average LTV ratios have risen.<sup>(2)</sup> Speculative office development has also been increasing rapidly and there is some concern about potential oversupply from around 2009.<sup>(3)</sup>

*...and syndicated lending activity continues to grow...*

Exposures to the corporate sector, in particular highly leveraged companies, may also have been growing because of the major UK banks' increasing trading activities and participation in the primary debt capital markets. These activities remain concentrated among a few major UK banks. For those banks, exposure to market and liquidity risks may also have been increasing (see Box 3); the median contribution of dealing profits to income has been steadily rising and is now around 6% (Chart 2.5).

Syndicated lending activity by participating UK banks has been growing rapidly over the past three years (Chart 2.6). The value of loans where one of the UK banks acted as a lead arranger<sup>(4)</sup> during 2005 was equivalent to 9.2% of the major UK banks' total assets at end-2005. The ultimate risk to banks' capital depends on the extent to which these exposures are sold on or hedged, which is difficult to assess. Leveraged lending is a specific type of syndicated lending that is typically

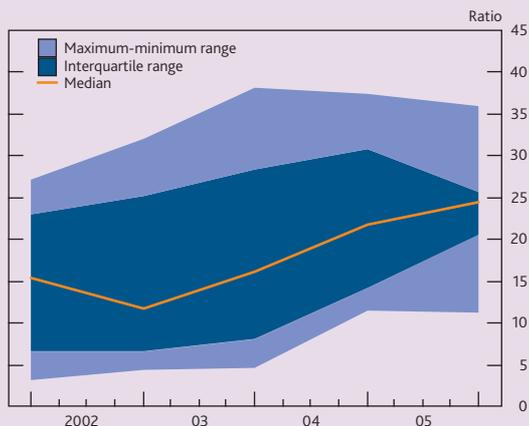
- (1) This includes companies involved in the development, buying, selling and renting of real estate. Exposures do not include banks' holdings of commercial mortgage-backed securities or loans to other companies collateralised by UK real estate.  
 (2) Maxted, W and Porter, T (2006), 'The UK commercial property lending market', De Montfort University.  
 (3) Drivers Jonas' Central London Crane Survey, 2006 Q1, available at [www.driversjonas.com/uk.aspx?doc=17283](http://www.driversjonas.com/uk.aspx?doc=17283).  
 (4) Lead arrangers are the set of banks that manage the syndication process, including selling the deal to the market and offering bridging finance, a facility that may or may not be called.

### Box 3

## Trading revenues and Value-at-Risk

In recent years, some UK banks have expanded their trading activities, so the contribution of dealing profits to income has been steadily rising (Chart 2.5). Unsurprisingly, this has been accompanied by larger trading book exposures to market risk, as proxied by disclosed Value-at-Risk (VaR) measures.<sup>(1)</sup> However, VaR measures have not risen as much as the rise in trading income might suggest — the ratio of dealing profits to VaR has been rising (Chart A). A similar picture emerges for the LCFIs over the past year. These institutions experienced a 50% increase in trading revenues in 2005, but this was accompanied by only a relatively small increase in their VaR (Chart B). This could mean that firms are diversifying their portfolios more efficiently. But it may also support the widely held view that VaR is an imperfect measure of risk in the trading book.

**Chart A** Major UK banks' dealing profits as a multiple of Value-at-Risk<sup>(a)(b)</sup>



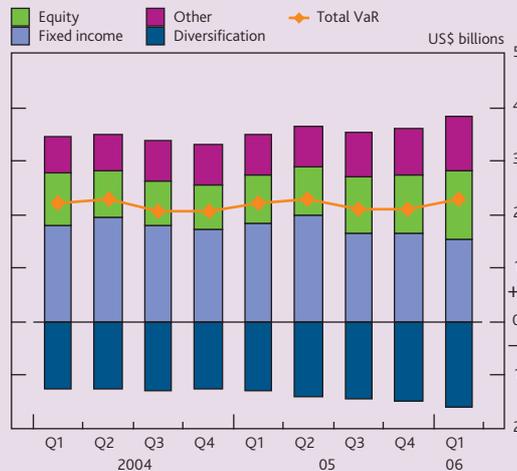
Sources: Published accounts and Bank calculations.

- (a) Data are for those major UK banks that report dealing profits.  
 (b) Average Value-at-Risk standardised to sterling, 99% confidence interval and a ten-day holding period.

One explanation for this is that VaR does not measure the expected loss of the portfolio; it indicates only the maximum loss that is likely to occur with a given level of confidence over a certain horizon. Moreover, VaR was developed principally as a tool to measure market risk, as encapsulated in asset price movements. So it may not fully capture a number of other risks increasingly inherent in the trading books of major UK banks and LCFIs but not reflected in market prices. For example, some assets in the portfolio may have high levels of liquidity risk — so that a fall in market liquidity has a large impact on prices — but this may be difficult to quantify. There may also be some model risk associated with the pricing of credit derivatives and other structured products. Given the lack of data on more innovative and complex instruments, it is possible that the models used to price them

and evaluate their risks will turn out to be inaccurate during times of stress.<sup>(2)</sup>

**Chart B** LCFIs' Value-at-Risk<sup>(a)(b)</sup>



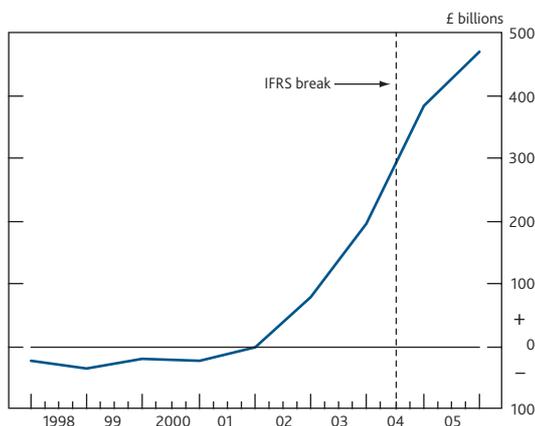
Sources: Published accounts and Bank calculations.

- (a) Standardised to US dollar, 99% confidence interval and a ten-day holding period.  
 (b) Data for selected LCFIs, where data are available.

These limitations highlight the need to complement VaR-based analysis with other risk measurement and management tools, such as stress tests. This need is well-recognised by most financial firms and so VaR is likely to be only one of a range of tools used by firms to manage trading positions. VaR is, however, reportedly being used by a number of firms as the basis for calculating initial margins on collateralised lending. This convention could have amplifying effects on asset prices. For example, a significant rise in VaR could cause prime brokers to increase their margin requirements on lending to hedge funds, perhaps triggering a sale of assets.<sup>(3)</sup>

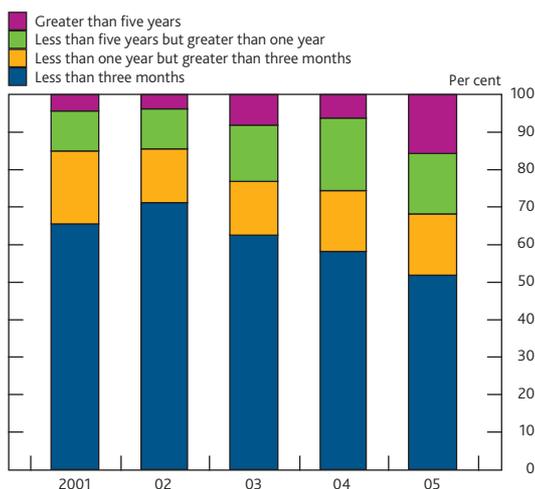
VaR measures are based on estimates of the volatility of asset returns and the correlation between them. The simplest approach to deriving volatility and correlation estimates is to use historical data. But as discussed in Section 1, both volatility and correlation have been low recently, at least prior to the market correction that began in May. Based on such backward-looking measures, current measures of VaR might therefore be understating risk — for example, low historical correlation estimates may be overstating the diversification effect in Chart B, which increased during 2005 and the first quarter of 2006. A sustained rise in volatility and/or correlation should feed through to higher VaR-based measures of risk, other things being equal. That could in turn amplify downward asset price movements due to VaR-based margining conventions.

- (1) The VaR of a portfolio measures the maximum loss likely to occur over a chosen holding period with a certain level of confidence. Equally, it describes the minimum loss likely to occur for a given probability.  
 (2) See (2006) Banque de France, *Financial Stability Review*, May, pages 51–61 and page 37 of the December 2005 *FSR* for a further discussion of these issues.  
 (3) See Box 5 for a more general discussion of financial market amplifiers.

**Chart 2.7** Major UK banks' customer funding gap<sup>(a)</sup>

Sources: Published accounts and Bank calculations.

(a) Data for 2004 and 2005 include securitised assets due to IFRS.

**Chart 2.8** Major UK banks' maturity breakdown of wholesale funding<sup>(a)(b)(c)</sup>

Sources: Published accounts and Bank calculations.

(a) Wholesale funding consists of debt securities in issuance and interbank deposits.

(b) Debt securities in issuance of maturity less than three months are estimated where necessary.

(c) Data for 2004 (where available) and 2005 include outstanding securitisations due to IFRS.

extended to sub-investment grade borrowers and allows them to take on particularly high levels of debt relative to equity. Chart 2.6 shows that most of the leveraged loan business in which the major UK banks have been involved has been leveraged buyout (LBO) related. As Section 1 discussed, this has been an area of heightened activity in recent years and the average leverage ratio for a typical European LBO has risen.

Acting as a lead arranger on these deals may involve taking a large exposure for a short period of time — for example, in the form of a bridge loan — until other financing, often a high yield bond issue, can be arranged for the borrower. These short-term loans may be significantly larger than the amount a lender would be willing to provide on a continuing basis. In this way, the major UK banks are effectively 'warehousing' risks that they intend to remove from their balance sheets when longer-term funding can be secured. The ability of lead arrangers to secure longer-term funding may depend on the financial environment remaining stable. This raises the possibility that, in the event of an unanticipated sudden deterioration in market conditions, the participating major UK banks (as well as other lead arrangers such as the non-UK LCFIs) could find themselves holding large, potentially overvalued, exposures.

### ...with funding more reliant on wholesale markets...

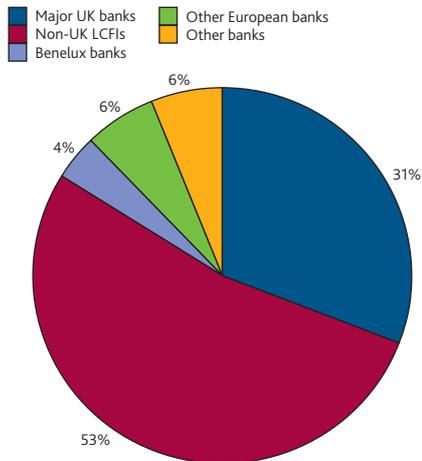
A further vulnerability to market conditions is evident on the liability side of the major UK banks' balance sheets. The customer funding gap,<sup>(1)</sup> which describes the amount of customer lending not financed through customer deposits, increased further in 2005 (Chart 2.7). At end-2005, it stood at almost £500 billion, or 11% of the major UK banks' total assets. This implies a greater reliance on sources of wholesale funding. These can take various forms, including interbank borrowing and the issuance of debt securities, such as mortgage-backed securities (MBS) and certificates of deposit (CD). These sources of funding tend to be more expensive than customer deposits and, with the notable exception of MBS and some asset-backed securities, need to be rolled over.<sup>(2)</sup> So their cost and availability is much more sensitive to market conditions. Concentrations among issuers or lenders could have a negative impact on liquidity in particular wholesale funding markets. In the sterling CD market, for example, the proportion of issuance accounted for by the largest UK banks has been increasing in recent years.

The major UK banks have responded to some of these concerns by diversifying their funding sources and extending the maturity over which they borrow. At end-2005, just under 50% of their wholesale funding had an outstanding maturity of greater than three months, compared to just

(1) Customer funding gap is customer lending less customer funding, where customer refers to all non-bank borrowers and depositors.

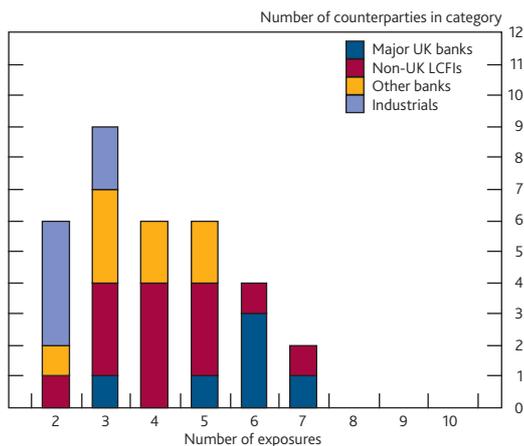
(2) Mortgage-backed securities provide matched funding for mortgage lending. Around half of the increase in the customer funding gap from 2004 to 2005 was met by securitisations.

**Chart 2.9** Major UK banks' 'large exposures' to banks and LCFIs by counterparty, end-March 2006



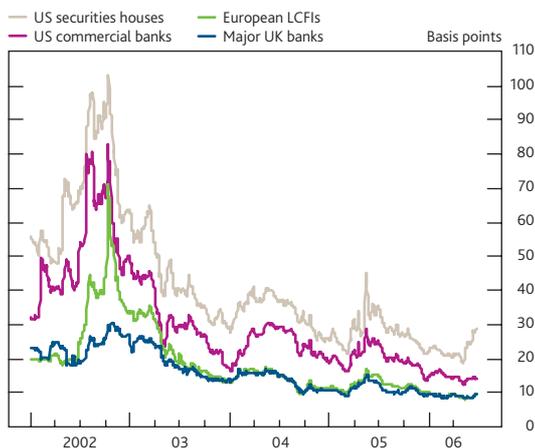
Sources: FSA regulatory returns and Bank calculations.

**Chart 2.10** Incidence of common 'large exposure' counterparts during 2006 Q1



Sources: FSA regulatory returns and Bank calculations.

**Chart 2.11** Major UK banks' and LCFIs' credit default swap premia<sup>(a)</sup>



Sources: Bloomberg, Markit and Bank calculations.

(a) Average premia weighted by total assets.

over 40% at end-2004 and around 34% at end-2001 (Chart 2.8).

*...and 'large exposures' to LCFIs increasing.*

Activity in the interbank market exposes the major UK banks to counterparty credit risk. At the end of 2005, the stock of interbank lending (combining secured and unsecured lending) was equivalent to over 200% of UK banks' Tier 1 capital. Exposures also arise through off balance sheet transactions between the major UK banks and other financial institutions, including the non-UK LCFIs. Regulatory 'large exposures' data capture both on and off balance sheet items.<sup>(1)</sup> The major UK banks' large exposures to non-UK LCFIs stood at £98 billion at the end of March 2006, equivalent to 63% of their Tier 1 capital. This exposure was up from £69 billion at end-2005 and represented 53% by value of the major UK banks' large exposures to banks and LCFIs (Chart 2.9). It is larger than the sum of bilateral large exposures within the set of major UK banks, of around £58 billion.

These large bilateral exposures are more important to the UK financial system the more frequently a particular institution appears as a counterparty. Chart 2.10 shows the incidence of large exposures (including banks, LCFIs and — by way of comparison — industrials) across the ten major UK banks during 2006 Q1. The more exposures there are to a particular counterparty, the greater the number of UK banks that would incur a significant loss in the event that counterparty fails. During 2006 Q1, there were twelve financial institutions that five or more of the major UK banks shared as a large exposure counterparty. Five of these institutions were other major UK banks and five were non-UK LCFIs.

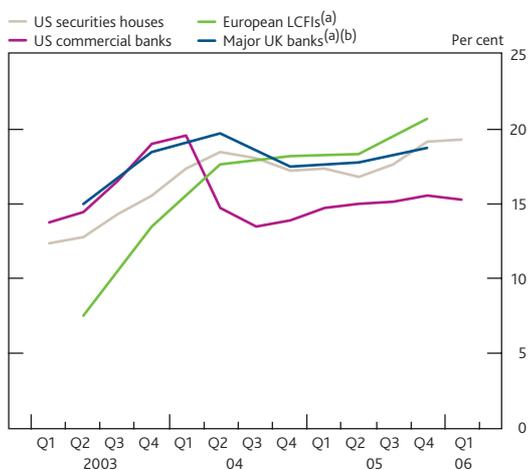
These data illustrate the strong links that exist between the major UK banks and LCFIs. They underscore the importance of these institutions to the UK financial system, as key intermediators of risk and as providers of liquidity to the capital markets.

*Market-based expectations of LCFI default probabilities remain low...*

The market's assessment of the default probability of LCFIs — as proxied by credit default swap (CDS) premia — has remained low over the past six months, although premia have risen since market volatility began to pick up recently (Chart 2.11). For example, CDS premia for the US securities houses have risen, on average, by around 10 basis points since the beginning of May. This is the largest sustained rise in CDS premia since May 2005, following the market reaction to the downgrade of General Motors (GM) and Ford. However, CDS premia remain lower than they were a year ago and the response of prices to the recent

(1) For regulatory purposes, 'large exposures' are defined as any exposures that exceed 10% of eligible capital (Tier 1 plus Tier 2 capital, less any regulatory deductions).

**Chart 2.12** Major UK banks' and LCFIs' return on common equity



Sources: Bloomberg and Bank calculations.

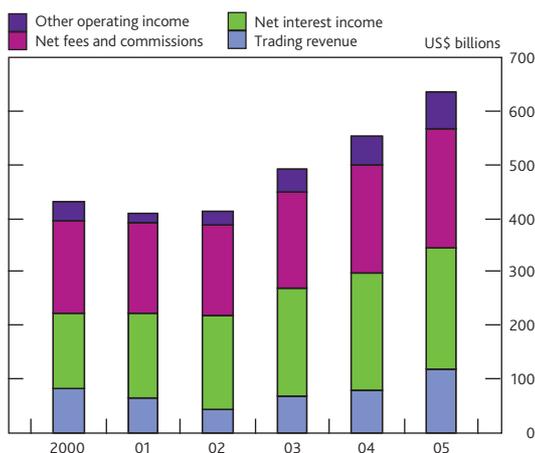
(a) Data for European LCFIs and major UK banks are half yearly.  
 (b) Data exclude Nationwide.

period of market volatility has been more modest than in May 2005.

*...with LCFI profits strong across the sector...*

In large part, this relatively muted response may reflect the continuing high profitability of LCFIs. As a group, the earnings performance of the LCFIs was strong during 2005 (Chart 2.12). The largest contribution to the rise in the revenues of the LCFIs came from their trading activities (Chart 2.13). This revenue stream includes profits both from trading client flows and from taking positions on a proprietary basis. Aggregated across the peer group, revenues from these activities rose by around 50% to \$120 billion in 2005. Trading revenues for the UK LCFIs doubled, in aggregate, over the same period. For those LCFIs that report quarterly figures, this strong growth continued into 2006 Q1. It is too soon to assess fully the impact of market conditions since May on trading revenues. But results for the US securities houses for the second quarter of 2006 suggest little impact to date.<sup>(1)</sup>

**Chart 2.13** LCFIs' revenue sources

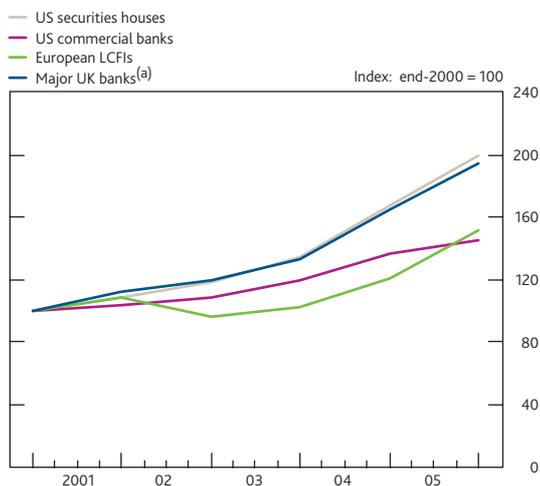


Sources: Bloomberg and Bank calculations.

*...resulting from an apparent increase in risk taking...*

A key factor in generating these revenues for the LCFIs appears to have been a willingness to take on more risk. Contacts report that firms have been extending their risk-taking activities despite the view of many that the premium for taking on risk is currently too low. This may reflect concerns about risks to future revenues and market share. In essence, business risk may have been perceived as greater than the balance sheet risks associated with potentially overpriced assets. Consistent with that, balance sheets have been growing strongly (Chart 2.14) and there has been some increase in leverage (Chart 2.15).<sup>(2)</sup>

**Chart 2.14** Major UK banks' and LCFIs' total assets



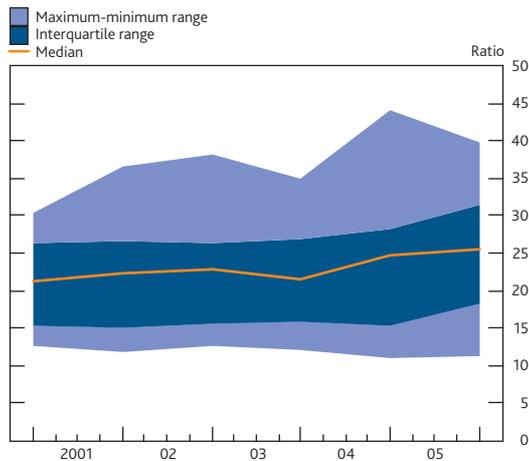
Sources: Bloomberg and Bank calculations.

(a) Due to changes introduced under IFRS, figures for 2004 and 2005 use the most comparable data possible.

Peer group competition may have been an important factor shaping current attitudes towards risk. In the current environment, there are strong competitive incentives to grow revenues and enhance shareholder value by emulating the business models of those LCFIs that have been particularly profitable in recent years. Reflecting this, more than one LCFI has publicly declared its intention to take on more risk through proprietary position-taking and trading.

As discussed in Section 1, demand for structured credit products is rising. Some tranches of bespoke structured deals are likely to be at the less liquid end of the asset spectrum. Those institutions originating and distributing structured products may be increasing their residual exposure to these assets, either directly through undistributed pieces of the deals originated, or indirectly as LCFIs accept assets as collateral to secure loans to hedge funds and other financial entities. For example, increasing competition among prime brokers has

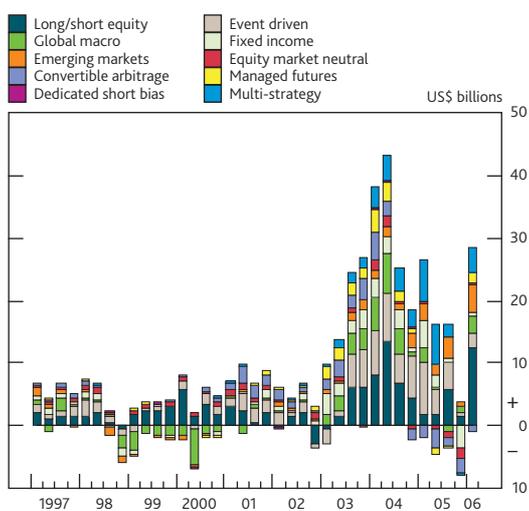
(1) Three LCFIs have a November financial year-end and so report Q2 results for March to May in mid-June.  
 (2) Gross leverage ratios may overstate the sensitivity of net worth to changes in underlying asset values (see Box 4).

Chart 2.15 LCFIs' leverage<sup>(a)</sup>

Sources: Bloomberg and Bank calculations.

(a) Leverage equals total assets divided by stockholders' equity.

Chart 2.16 Net capital flows into hedge funds



Source: Tremont Capital Management, Inc.

reportedly led, in some cases, to reductions in haircuts<sup>(1)</sup> on high quality collateral and/or to a willingness by some dealers to accept less liquid instruments as collateral. At the same time, the LCFIs have sought to improve their liquidity management — for example, the proportion of the US LCFIs' debt maturing within five years fell from an average of 72% to 67% between 2002 and 2005, while the share of debt due within one year fell from 22% to 15%. Holdings of 'cash' have also risen at certain institutions.

#### ...supported by strong hedge fund activity.

The activity of hedge funds continues to be supported by a net inflow of capital. In the last quarter of 2005, hedge funds did experience a net outflow of funds for the first time since 2002 Q4. But this was more than reversed in the first quarter of 2006, with net inflows reaching \$27.6 billion (Chart 2.16). As with LCFIs, relatively benign liquidity and volatility conditions may have encouraged greater leverage and risk taking among hedge funds in recent years. Leverage is difficult to measure, particularly so for hedge funds where the data are partial. Most estimates seem to suggest that while leverage is picking up, on average, it is not currently at particularly high levels (see Box 4).

Given uncertainties about the precise balance sheet position of hedge funds, it is difficult to know how they might respond to a period of market turbulence. In May 2005, hedge funds were a useful source of liquidity, in particular in structured credit markets, following concerns about prospects for GM and Ford. But hedge funds cannot automatically be relied on to alleviate stresses in financial markets. For example, market contacts suggest hedge funds (and other active traders) may have amplified volatility in asset prices during May and June, perhaps reflecting common strategies among these investors. One key factor in determining hedge funds' future behaviour is likely to be the response of their investors and prime brokers to any deterioration in their returns (see Box 5).

#### Operational risks associated with over-the-counter (OTC) derivatives are also a concern...

Operational risk often arises when financial innovation outpaces risk management at financial firms and supporting infrastructure. A notable example is the back-office problems associated with the processing of certain OTC derivatives, particularly credit products — namely, delays in the confirmation, matching and assignment of trades. In the past year, an initiative launched by the Federal Reserve Bank of New York, in collaboration with the UK FSA, other international regulators and the financial industry, set ambitious targets for reducing these backlogs. So far, these targets have been hit by the majority of the large financial

(1) A 'haircut' is a percentage subtracted from the market value of an asset that is being used as collateral. The size of the haircut should reflect the perceived risk associated with the asset and therefore account for the potential decline in value that may occur before the asset can be liquidated.

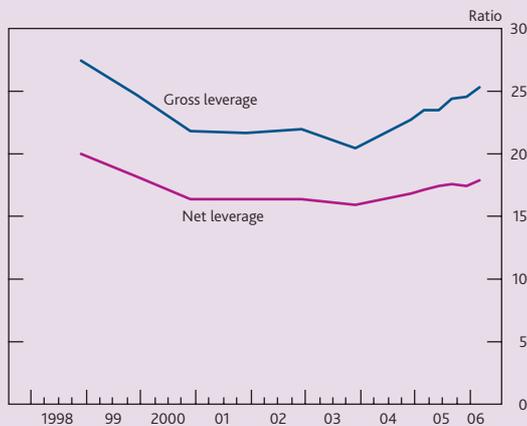
## Box 4 Leverage

Leverage increases the sensitivity of net worth to changes in asset prices. It is obtained either through borrowing (balance sheet leverage) or through off balance sheet transactions, such as derivative instruments, whose values fluctuate by a multiple of the change in the underlying referenced asset (embedded leverage).

### Balance sheet leverage

The simplest measure of balance sheet leverage is the ratio of the book value of total assets to the book value of equity. A more sophisticated measure is the net leverage ratio which is calculated by first deducting from total assets forms of secured lending that are matched by secured liabilities, and then adding certain liabilities, such as short positions in (non-derivative) securities, that are affected by changes in market prices. As an illustration, Chart A shows that, while gross leverage at the four largest US securities houses is now back at the level of early 1999, the rise in net leverage has been more modest.

**Chart A** Gross<sup>(a)</sup> and net<sup>(b)</sup> leverage of US securities houses<sup>(c)(d)</sup>



Sources: SEC filings and Bank calculations.

- (a) Gross leverage equals total assets divided by stockholders' equity.  
 (b) Net leverage equals net assets divided by stockholders' equity. Net assets equal total assets minus collateralised lending, plus securities sold but not yet purchased, minus derivative liabilities.  
 (c) Calculations include Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley.  
 (d) Annual data up until end-2004, quarterly data thereafter.

### Embedded (risk-based) leverage

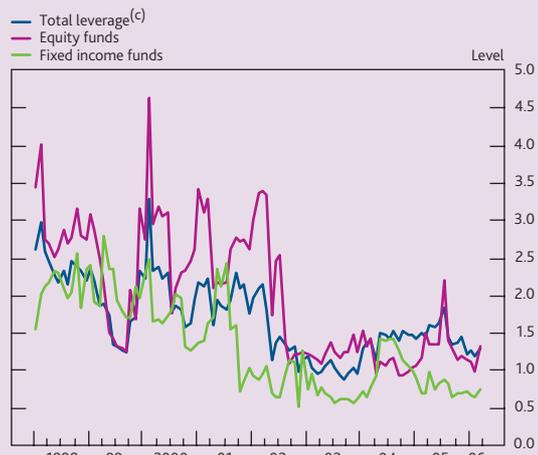
A financial institution's wider exposure to changes in market prices can be harder to identify because of the presence of embedded leverage. An interest rate swap or credit derivative, for example, may have zero value at inception and so will not appear on the balance sheet. However, by entering into the contract, an institution has increased its exposure to changes in the price of the referenced index or credit. In this case, the delta<sup>(1)</sup> is the appropriate measure of

leverage. But this delta can be difficult to calculate for whole portfolios.

### Hedge fund leverage

To estimate hedge fund leverage, the Bank for International Settlements (BIS) regresses the returns on a portfolio of hedge funds on a set of risk factors that are considered to affect the returns on different asset classes. From this, the sensitivity of their asset values to market prices can be estimated. This represents the combined effects of both balance-sheet and embedded leverage. Chart B suggests that total hedge fund leverage was high before the LTCM crisis and peaked in early 2000. The estimates corroborate reports from market contacts who suggest that hedge funds are generally not as highly leveraged as they were in the late 1990s. However, it is important to note that reporting coverage of the data is incomplete.<sup>(2)</sup>

**Chart B** BIS indicators of hedge fund leverage<sup>(a)(b)</sup>



Source: BIS.

- (a) The estimate of leverage is based on a refinement of the procedure detailed in McGuire, P, Remolona, E and Tsatsaronis, K (2005), 'Time-varying exposures and leverage in hedge funds', *BIS Quarterly Review*, March.  
 (b) Leverage is estimated separately for different families of hedge funds by regressing hedge fund returns on a variety of market-based risk factors using a 24-month rolling regression window.  
 (c) Total leverage is the weighted measure of leverage for each hedge fund family (weighted by the average assets under management over the 24-month window).

- (1) Delta measures the ratio of the change in the price of the instrument to the change in the price of the underlying asset.  
 (2) For a discussion of hedge fund data limitations see Box 10 pages 64–65 of the June 2005 FSR.

## Box 5

### Financial market amplifiers

Various structural features of capital markets may amplify movements in asset prices. These mechanisms may temporarily push prices away from equilibrium levels — for example, by causing prices to overshoot in response to a shock. This behaviour is likely in turn to have a negative impact on market liquidity, regardless of whether or not the initial price movement was warranted.

A topical source of market amplification derives from the hedging of volatility or variance swaps. These are instruments through which investors can insure against large movements in asset prices. Dealers buying these swaps take on the risk associated with an increase in volatility and can hedge their positions by selling a package of options. But this then exposes them to movements in the price of the underlying asset and so the options may in turn need to be hedged. In particular, a fall in the underlying asset price would require the dealers to sell assets. During the market turbulence in May, it was reported that such hedging activity, in particular by LCFIs and hedge funds, may have amplified volatility in the equity markets.<sup>(1)</sup>

This is a specific example of a more generic source of market amplification: investors who have sold options and need to hedge their positions dynamically when prices fall.<sup>(2)</sup> Other possible amplifying mechanisms include:

- **Algorithmic trading funds.** If funds hardwire trading decisions on the basis of trends or market momentum, a move in prices could be amplified by these funds' actions.
- **Unwind of 'carry trades'.** Some trades may be profitable only within a certain constellation of market prices. An example is the so-called 'carry trade'. The performance of these trades relies on the ability of the market participant to fund a long position in an asset by rolling over short-term funding relatively cheaply. A narrowing of the spread between the expected risk-adjusted returns on the investment asset and the cost of funding can therefore prompt further moves as these trades are unwound.
- **Asset-liability management.** Institutions that aim to offset asset and liability risks, but are not as yet fully matched, may buy assets as prices rise and *vice versa*. An example is the fall in long-dated gilt yields discussed in Box 1; this raised the value of pension fund liabilities, leading some funds to demand more gilts.

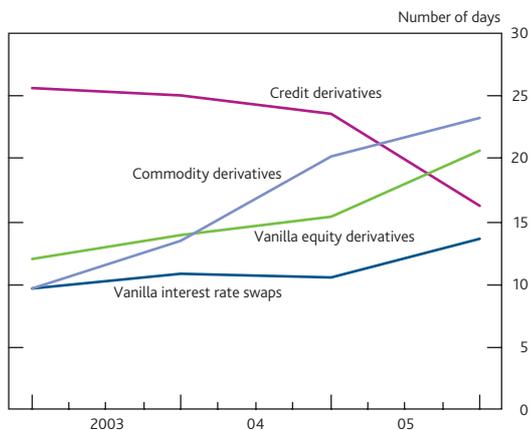
These financial market dynamics can become more acute when a sustained fall in market liquidity coincides with or, in particular, triggers funding problems for institutions. Some examples in which the availability and cost of funding may be contingent on the performance of assets include:

- **A reliance on unsecured lending.** The cost and availability of such funding depends on the credit quality of an institution. An institution that suffers significant losses on its assets may therefore find itself unable to obtain sufficient funding at reasonable cost on an unsecured basis.
- **Margining of collateral.** Secured lending backed by collateral might also present a vulnerability if asset price falls lead to additional margin calls on the collateral posted, which might only be able to be met by liquidating other assets. Moreover, if margins are based on Value-at-Risk (VaR) measures, a rise in market volatility or correlation could trigger additional margin calls (see Box 3 for a general discussion of VaR).
- **Constant proportion portfolio insurance (CPPI).** These are transactions that include a specific provision that some assets must be sold when the value of assets falls. They are designed to protect the investor against further losses. When the underlying assets are investments in hedge funds (through funds of funds based on CPPI structures), this requires a withdrawal of capital from those funds, which might worsen selling pressure.

There are many ways in which financial institutions can attempt to mitigate these risks. For example, hedge funds have recently sought to enforce 'lock-ins' for funding and to agree fixed margins on borrowing with their prime brokers (who are then exposed to greater counterparty credit risk if collateral values fall). In the United Kingdom, banks appear in recent years to have extended the maturity of their liabilities to lower the proportion of their customer funding gap that they would need to roll over during times of stress.

(1) See the box on equity variance swaps, *Bank of England Quarterly Bulletin* (2006), Summer, page 127.

(2) A number of other examples were discussed in Box 9 of the June 2005 *FSR*, page 60 and Tucker, P (2005), 'Where are the risks?', *Financial Stability Review*, December, pages 73–77.

**Chart 2.17** Outstanding confirmations at large firms<sup>(a)</sup>

Source: ISDA Operations Benchmarking Survey (2006).

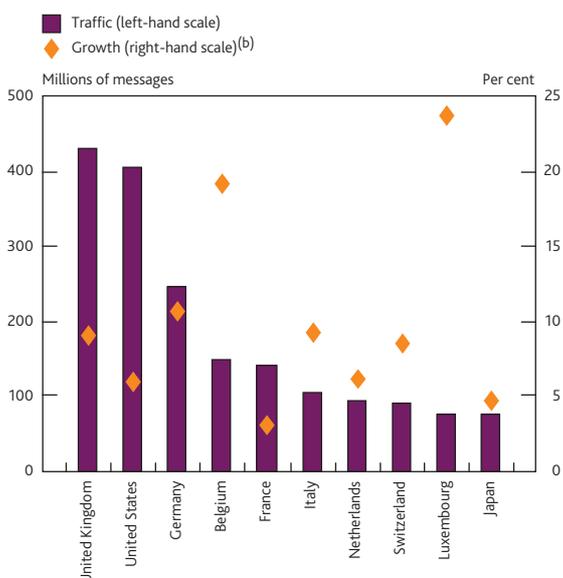
(a) Confirmation backlogs are expressed in terms of the number of days worth of business, calculated by dividing the number of outstanding confirmations by the daily volume of new trades.

firms, at least for standardised credit derivative products. However, further work needs to be done to address backlogs in other products, some of which have increased in the past year (Chart 2.17). Looking further ahead, there is a case for a greater proportion of OTC derivatives being cleared centrally, to help reduce the scope for such problems.

*...as are dependencies on market infrastructures.*

Another source of operational risk arises from the common dependence of financial institutions on certain key market infrastructures. All financial institutions rely on these infrastructures to support payments, clearing and settlement of financial transactions.

The four market infrastructures on which financial institutions operating in the United Kingdom most rely are CHAPS (the United Kingdom's high-value payment system), CLS (a global exchange of value system in a number of foreign currencies), CREST (the United Kingdom's securities settlement system) and LCH.Clearnet Ltd (the United Kingdom's central counterparty for the clearing of derivatives and some cash markets). The value of transactions going through these systems is substantial — for example, daily averages in 2005 were around £300 billion per day in CREST and just under £210 billion per day in CHAPS.

**Chart 2.18** Traffic sent in SWIFT by location of sending entity 2005<sup>(a)</sup>

Source: SWIFT.

(a) Traffic refers to chargeable FIN messages.  
(b) Percentage growth in 2005 compared to 2004.

As well as facilitating transactions, market infrastructures have an important role to play in reducing the risks associated with these transactions. For example, central counterparties such as LCH.Clearnet Ltd reduce counterparty risks by interposing themselves between buyers and sellers; while CHAPS settles payments gross and in real time allowing its participants to exchange large values without incurring substantial intraday credit exposures. In CREST and CLS, participants settle both legs of a transaction simultaneously, avoiding the credit risk associated with a timing mismatch.

Because payment and settlement systems are increasingly closely linked, disruption to any of these infrastructures could lead to the build-up of significant settlement-related credit and liquidity exposures on UK banks' balance sheets.<sup>(1)</sup> A key source of interdependence among UK market infrastructures arises from the role played by SWIFT — a provider of secure messaging services to support transactions between financial institutions and infrastructures. CHAPS, CREST, CLS and LCH.Clearnet Ltd are all dependent on SWIFT messaging. This helps explain why the United Kingdom is the largest user of SWIFT FIN<sup>(2)</sup> services internationally, as measured by traffic sent (Chart 2.18). As Section 4 discusses, these

(1) Under the Memorandum of Understanding (MoU) between the Bank, the Financial Services Authority and HM Treasury, the Bank is responsible for overseeing payment systems that are of systemic significance to the United Kingdom. As part of discharging its responsibilities, the Bank publishes an annual *Payment Systems Oversight Report*, available at [www.bankofengland.co.uk/publications/psor/psor2005.pdf](http://www.bankofengland.co.uk/publications/psor/psor2005.pdf).  
(2) SWIFT FIN is one of SWIFT's core messaging services.

interdependencies underscore the importance of each of these individual infrastructures, and the users of them, having adequate contingency plans to deal with an, albeit highly unlikely, operational disruption.

## 3 Prospects for the UK financial system

The UK financial system has weathered well a series of disturbances over the past six months. Major UK banks' reported profitability and capital levels have remained strong. But given its financial stability mandate, the Bank is monitoring a number of key vulnerabilities that could — in unlikely circumstances — potentially disrupt the UK financial system. Some of these vulnerabilities appear to have increased slightly since the December 2005 *FSR*. While the UK financial system remains highly resilient and the chance of these vulnerabilities crystallising is low, the impact in that unlikely event could be significant.

This section of the *Report* assesses the resilience of the UK financial system, in the light of developments in the macroeconomy and financial markets (discussed in Section 1) and in the structure of the system (discussed in Section 2).

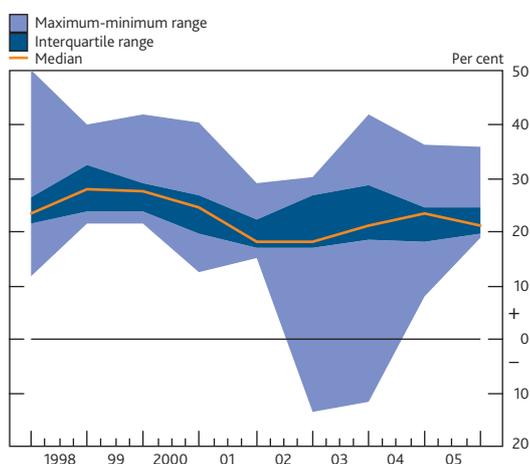
### 3.1 UK banks' resilience

*UK banks' financial buffers remain high.*

The UK financial system has been highly resilient over recent years in the face of a number of disturbances, including oil and commodity price shocks and, most recently, sharp falls in some asset prices. There are several potential explanations for this ongoing strength and flexibility. In part, it appears to reflect improvements in risk management. Innovations in capital markets have also helped in the distribution of risk, in particular credit risk, in the United Kingdom and internationally. Finally, the UK financial system has accumulated significant financial buffers of profits and capital over the past few years, which have helped insulate it from disturbances.

Published accounts indicate that the profitability of the major UK banks remained strong in 2005. Aggregate profits for the major UK banks were around £40 billion in 2005. The median pre-tax return on equity for the nine listed banks fell slightly to 21.1% in 2005, but remained high (Chart 3.1). The range of outcomes narrowed somewhat, with all of the major UK banks having pre-tax returns on equity around or sometimes

**Chart 3.1** Major UK banks' pre-tax return on equity<sup>(a)(b)</sup>

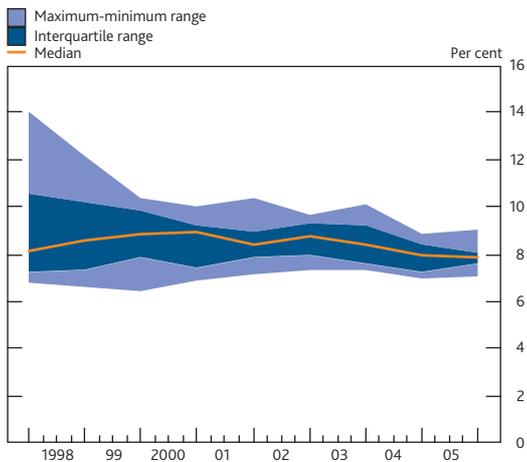


Sources: Published accounts and Bank calculations.

(a) Excludes Nationwide due to lack of data.

(b) Pre-tax return on equity calculated as pre-tax profit as a proportion of shareholders' funds and minority interests.

**Chart 3.2** Major UK banks' Tier 1 capital ratios



Sources: Published accounts and Bank calculations.

**Table 3.A** Net assessment of news since the December 2005 FSR

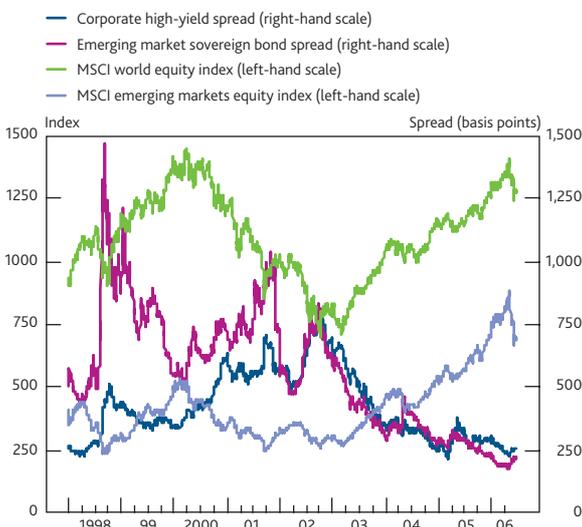


Vulnerability	Probability <sup>(a)</sup>	Impact <sup>(b)</sup>
Low risk premia	Broadly unchanged	A slight increase in risk
Global imbalances	A slight decrease in risk	A slight increase in risk
Global corporate debt	A slight increase in risk	A slight increase in risk
UK household debt	A slight increase in risk	Broadly unchanged
LCFI stress	Broadly unchanged	A slight increase in risk
Infrastructure disruption	Broadly unchanged	A slight increase in risk

Source: Bank calculations.

- (a) Assessed change in the probability of a vulnerability being triggered over the next three years.
- (b) Assessed change in the expected impact on major UK banks' balance sheets if a vulnerability is triggered.

**Chart 3.3** Bond spreads and equity indices



Sources: JPMorgan Chase & Co., Merrill Lynch and Morgan Stanley.

substantially in excess of 20%. As Section 2 discussed, this strong performance broadly mirrors the pattern seen by financial institutions globally.

Major UK banks' published capital ratios remain comfortably above Basel regulatory minima. At end-year 2005, both the median Tier 1 and total capital ratios were broadly unchanged on a year earlier at 7.9% and 12.0% respectively (Chart 3.2). In levels terms, at the end of 2005 the major UK banks collectively had a published Tier 1 capital buffer of around £160 billion.

### 3.2 What are the key vulnerabilities?

*The Bank has explored six key vulnerabilities...*

The Bank's financial stability mandate requires it to consider not only the most likely outcome, but also major downside risks to the UK financial system. By their nature, these risks are likely to be few in number and the chance of them leading to significant problems is very low. But to gauge the ongoing resilience of the system, and to help guide risk mitigation work, it is nonetheless useful to assess and, where possible, quantify their potential scale.

To that end, this *Report* explores six main sources of vulnerability for the UK financial system. None of them is new and most are long standing. The characteristics of the vulnerabilities themselves differ. Some arise from potential mismatches or mispricing in international financial markets. Others are rooted in extended balance sheet positions in parts of the corporate and household sectors. Others still reflect structural dependencies within the financial system.

Table 3.A summarises how news since the December 2005 FSR, discussed in Sections 1 and 2, has affected both the likelihood of problems arising through each of the key vulnerabilities (probability) and their potential consequences for the UK financial system (impact). So what are these key vulnerabilities and how have they changed in the light of this news?

*Unusually low risk premia in asset markets.*

As Section 1 discussed, asset prices have risen considerably over the past few years, dwarfing recent price falls (Chart 3.3). Some of the drivers of rising prices — such as financial innovation that allows risks to be better matched to investors' preferences — are likely to endure. So risk premia may remain lower on average than in the past. But other factors that may have boosted prices, such as low global risk-free yields and benign macroeconomic conditions, may not last indefinitely. Against that backdrop, and despite recent market falls, the price of risk in financial markets still appears somewhat low. Certainly, risk premia on a number of financial assets remain low by historical standards.

A sustained unwinding of the price rises seen in recent years across a range of asset markets — including equities, corporate and emerging market credits — would affect directly financial institutions with significant exposures to these assets, including large complex financial institutions (LCFIs), hedge funds and some internationally active UK banks. Other UK banks would also be affected indirectly through counterparty credit links and through dependencies on wholesale market funding. And all banks may face losses if asset price falls were accompanied by a substantial weakening in the financial position of borrowers.

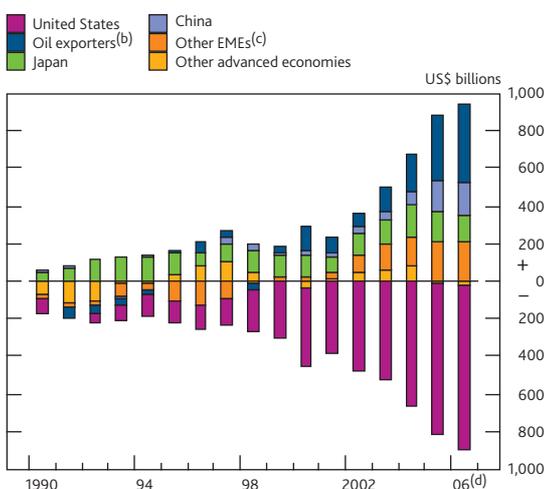
In the early part of this year, benign macroeconomic developments were associated with a further rise in global asset prices across much of the risk spectrum. But more recently there have been signs of a shift in sentiment, manifest in sharp market adjustments during May and June. As Section 1 discussed, the net impact of these developments has been to take many asset prices back to around levels prevailing at the start of the year. That suggests that the likelihood of a sharp correction in risk premia is broadly unchanged over the period as a whole (Table 3.A). While it is too early to assess fully the consequences of recent market events, the apparent build-up in risk exposures in the early part of the year suggests that the likely impact on the UK financial system of any future correction in risk premia has probably increased slightly since December.

#### *Large financial imbalances among the major economies.*

International financial imbalances have grown significantly in recent years (Chart 3.4). The US current account deficit has reached unprecedented levels and surpluses among Asian economies and, more recently, oil exporters have increased markedly. These imbalances, and their associated financing, cannot be sustained indefinitely. The question is whether the adjustment path towards more balanced global capital flows will be smooth or abrupt. Policies to support a smooth adjustment have been identified, including by the G7.<sup>(1)</sup> But while large imbalances persist, the risk remains of a disorderly correction involving sharp movements in asset prices and exchange rates. This could in turn affect the UK financial system through its potentially pervasive impact on capital markets and asset prices, global growth and credit risks.

Section 1 noted that global imbalances are larger than they were six months ago, suggesting that the potential impact of a disorderly unwind may have increased slightly over the period (Table 3.A). But the likelihood of such a disorderly adjustment may have decreased slightly, as US growth and interest rate differentials with other economies have narrowed and the US dollar has depreciated. As Section 4 discusses, recently agreed International Monetary Fund (IMF) procedures to

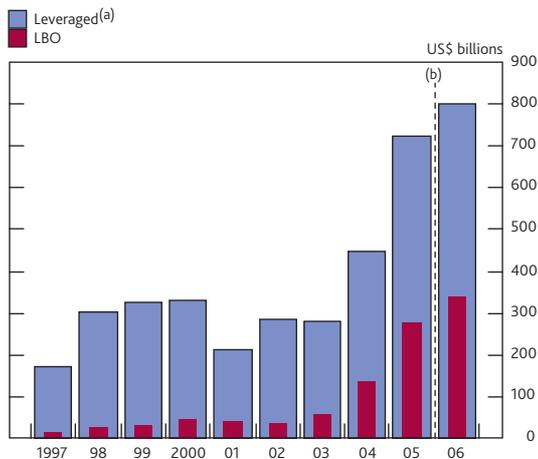
**Chart 3.4** Global current account balances<sup>(a)</sup>



Source: IMF.

- (a) Global current account balances do not sum to zero due to errors and omissions.  
 (b) The sum of the ten largest oil exporters in 2004 — Algeria, Iran, Kuwait, Mexico, Nigeria, Norway, Russia, Saudi Arabia, United Arab Emirates and Venezuela.  
 (c) Other EMEs includes the Newly Industrialised Asian economies.  
 (d) IMF forecast, April 2006.

(1) See the statement by G7 Finance Ministers and Central Bank Governors, 21 April 2006, at [www.ustreas.gov/press/releases/js4199.htm](http://www.ustreas.gov/press/releases/js4199.htm).

**Chart 3.5** Leveraged loan issuance

Source: Dealogic.

(a) Includes both leveraged and highly leveraged loans, typically priced at spreads of 150 basis points or more.

(b) Data for 2006 are annualised based on Q1 and Q2.

convene multilateral discussions, including on imbalances, may also in time support smooth adjustment.

#### *Rapid deleveraging in parts of the corporate sector globally.*

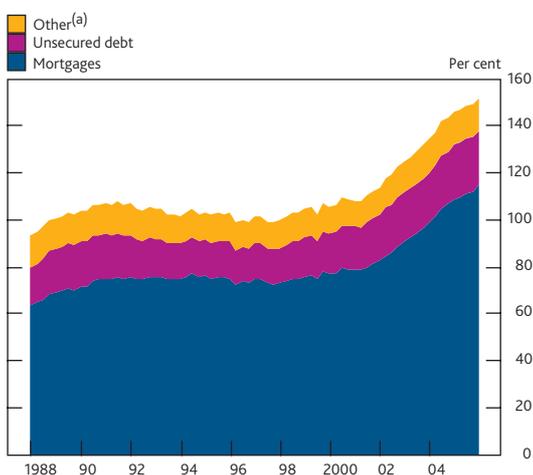
Corporate balance sheets are generally strong globally. Benign macroeconomic conditions have helped keep insolvencies and write-offs on banks' corporate exposures at very low levels. But deleveraging is taking place rapidly in some parts of the corporate sector. As Section 1 discussed, leveraged loan issuance, including to finance leveraged buyouts (LBOs), also remains strong (Chart 3.5). Indeed, the threat of LBOs, often involving private equity firms, may be encouraging a widening and deepening of corporate deleveraging. UK bank lending to the commercial property sector has also grown rapidly in recent years. At the same time, strong competition for corporate exposures has meant margins on UK commercial property lending have fallen further, while credit spreads on corporate debt are at historically low levels. Over time, these factors could add impetus to the accumulation of corporate sector debt, leading to a gradual build-up in this vulnerability.

Lending to UK companies accounts for around 6% of the total assets of the major UK banks; and UK banks also have significant overseas corporate sector exposures. Taken together, recent developments suggest that the potential impact on the UK financial system of any future shocks to corporate balance sheets has increased slightly over the past six months (Table 3.A). Although corporate profitability generally remains strong, rising input prices and tightening global monetary conditions may increase financial pressures on some companies. So the likelihood of such an event may have edged up too.

#### *High UK household sector indebtedness.*

Over recent years, strong macroeconomic conditions, advances in credit risk management techniques and rising house prices have been accompanied by a rapid build-up in household indebtedness. Unsecured lending has grown especially rapidly over the past five years; secured lending has also grown strongly. Higher asset prices, particularly rises in house prices, have boosted household net wealth. But higher debt levels mean households are potentially sensitive to adverse shocks: the ratio of household debt to income has risen from 100% in the late 1990s to around 150% (Chart 3.6). UK household sector lending accounts for 20% of the total assets of major UK banks. The bulk is mortgage lending, where low average loan to value ratios of around 45% provide a substantial cushion to protect banks against losses. But write-offs on unsecured lending have picked up significantly in recent months.

As discussed in Section 1, rising personal insolvencies may reflect pockets of vulnerability within the household sector. At the same time, some households may be undergoing a change in their attitudes towards personal bankruptcy. These

**Chart 3.6** Ratio of household sector debt to annualised post-tax income

Sources: ONS and Bank calculations.

(a) Households' total financial liabilities excluding secured and unsecured debt (including bills that are due to be paid).

developments may point to a small rise since December in the likelihood of household sector vulnerabilities crystallising (Table 3.A). On the other hand, as Section 2 discussed, banks have tightened lending criteria, unsecured lending growth has eased further and write-off rates on mortgage lending remain extremely low. Overall, these factors suggest that the potential impact of household sector vulnerabilities on UK banks is broadly unchanged since the December 2005 FSR.

#### *The rising systemic importance of LCFIs.*

LCFIs play a pivotal role in the international financial system as intermediators of risk and as providers of liquidity to capital markets. As a result, the impact on global capital markets and the UK financial system of any stress to LCFIs' balance sheets could be significant. This would be true whether LCFIs themselves were a source of disturbance or were a propagator of shocks elsewhere in the system.

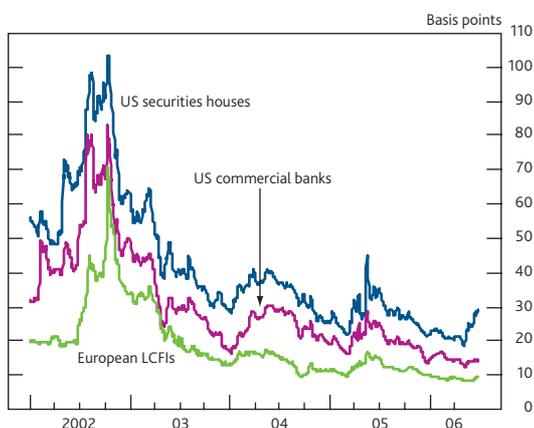
As discussed in Section 2, LCFIs' balance sheets have expanded rapidly over recent years, in part apparently reflecting increased risk taking. Buoyant financial market conditions and intense peer group competition may have helped spur these developments. While many firms may have believed that the price of some assets had become too high and the premia for taking risk too low, there are also risks in not expanding activities when others are doing so — for example, prime brokerage business with hedge funds and activity in structured finance markets. Firms' ability to manage risk has improved markedly in recent years. But there are indications that the growing complexity of some financial instruments may sometimes outpace the capacity of the LCFIs or their counterparties to manage the associated risks — for example, in the area of settling and confirming credit derivative transactions. As noted in Section 2, this is an issue that the industry itself recognises and is tackling. UK banks' counterparty links with LCFIs are also increasing.

Taken together, higher risk taking and strengthening links to the UK financial system suggest that the potential impact of any stress at an LCFI on the UK financial system may have risen over the past six months (Table 3.A). The Bank's judgement is that the likelihood of severe distress at an LCFI is very low and unchanged from six months ago. Their profitability remains strong, they are highly capitalised and they have well-diversified activities. The low likelihood of severe distress at an LCFI is evident in the market's assessment of LCFI credit risk, as proxied by credit default swap (CDS) premia, which remained low over the past six months (Chart 3.7).

#### *Dependence of UK financial institutions on market infrastructures and utilities.*

Financial systems depend on the smooth functioning of financial market infrastructure. As Section 2 discussed, financial institutions in the United Kingdom rely particularly on

**Chart 3.7** LCFIs' credit default swap premia<sup>(a)</sup>



Sources: Bloomberg, Markit and Bank calculations.

(a) Average premia weighted by total assets.

CHAPS, CLS, CREST and LCH.Clearnet Ltd for clearing and settling financial transactions. These systems are closely interlinked, so disruption to any one of them could have large and widespread implications. A particularly significant common dependency within the United Kingdom's financial infrastructure is on the messaging services provided by SWIFT, which are used by most UK financial firms and wholesale market infrastructures. These dependencies underscore the importance of market infrastructure providers and the users of their services having effective contingency plans in place for the very unlikely event of an outage at a major infrastructure. As discussed in Section 4, further work is needed to put in place and test such plans.

As set out in the Bank's *Payment Systems Oversight Report 2005*,<sup>(1)</sup> the UK payment systems remain robust when judged against international standards. And severe disruption to SWIFT messaging services is a remote possibility as there is extensive contingency planning at SWIFT, including multiple backup sites and systems. The likelihood of severe problems in market infrastructures and utilities is assessed to have not materially changed over the past six months (Table 3.A). The impact of any disruption is also judged not to have altered significantly over the period.

*Overall, these vulnerabilities may have edged up slightly.*

Taken together, news on the key vulnerabilities since the December 2005 FSR, summarised in Table 3.A, suggests that a number have continued to build, albeit gradually. This has raised slightly their potential impact on the UK financial system in the very unlikely event that they should crystallise. Overall, the likelihood of disturbances triggering these vulnerabilities is little changed since December.

### 3.3 Prospects for the UK financial system

*Stress tests provide a rough guide to the system's resilience...*

To assess the resilience of the UK financial system, a judgement needs to be made not just on whether the vulnerabilities have increased or decreased, but on how serious they might be relative to the financial system's buffers of profits and capital. This is extremely challenging and inevitably involves a substantial degree of subjective assessment. As a contribution to that judgement, the Bank has recently considered a number of hypothetical stress scenarios in which each of the key vulnerabilities is triggered and has assessed their effects on the UK financial system using a range of models. These stress-testing exercises are not a forecast of what is likely to happen to the UK financial system. Rather, they are a series of 'what if?' thought experiments to assess the resilience of the system to certain low probability,

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(1) The Bank's annual *Payment Systems Oversight Report* is available at [www.bankofengland.co.uk/publications/psor/psor2005.pdf](http://www.bankofengland.co.uk/publications/psor/psor2005.pdf).

but plausible, stress events. These stress tests, while hypothetical, are a useful starting point for understanding the channels of risk transmission that might operate in periods of significant strain and for gauging their likely importance. They can also be helpful in identifying risk mitigation work and in contingency planning for extreme events.

Box 6 explains the approach used, sets out the extreme stress scenarios considered and describes the channels through which the UK financial system could be affected. It also provides some preliminary, illustrative estimates of losses that might arise for the major UK banks in the unlikely event that these scenarios were to crystallise.<sup>(1)</sup> The various channels through which stress might affect financial institutions can be shown using a 'risk transmission map', which is illustrated in Box 7 by reference to the Russian debt default and the near-failure of Long-Term Capital Management (LTCM) in 1998. This illustration underscores the challenges faced in assessing in advance how crises might unfold and the importance of complementing analytical stress-testing work with market intelligence when forming an overall judgement on the importance of different vulnerabilities.

*...with the impact of adverse events depending on how quickly they unfold...*

Banks' ability to absorb stress depends importantly on the speed with which adverse events unfold. Some of the stress events described in Box 6 — such as those associated with household debt and corporate debt — may develop relatively gradually, giving time for banks to adjust, for example, by changing lending criteria or margins or by strengthening financial buffers. This would cushion the impact of these vulnerabilities if they crystallised.

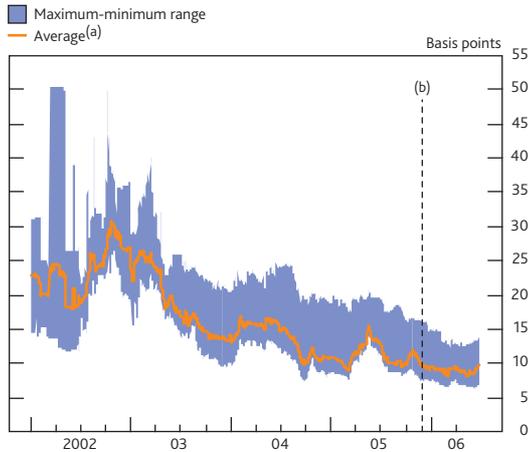
The scenarios whose epicentre is located more directly within the financial sector — such as adjustments in risk pricing, LCFI stress and disruption to market infrastructure — may unfold more rapidly. In these cases, sharp falls in asset prices, uncertainty about market liquidity and about the responses of other market participants could amplify their impact. Current profits may not be available to absorb losses, so these events may have greater impact on banks' capital. That in turn might also lead to increases in institutions' funding costs in wholesale markets and higher collateral requirements in trading activities.

*...but continuing resilience remains the most likely outcome...*

Far and away the most likely outcome in the near term is that none of the vulnerabilities crystallise. Even if these low probability tail events were to occur, preliminary results from the stress-test models, described in Box 6, suggest that

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<sup>(1)</sup> These stress tests focus on possible losses that might arise for major UK banks, as an indication of the potential impact across the UK financial system.

**Chart 3.8** Major UK banks' credit default swap premia

Sources: Bloomberg, Markit and Bank calculations.

- (a) Average CDS premia weighted by total assets.  
 (b) December 2005 FSR.

individually they would be unlikely to erode to any significant extent the capital base of the UK banking system. For example, in the unlikely event that one of the 'slow burn' stress scenarios materialised, profits of the major UK banks would be likely to absorb losses. And losses in each of the 'fast burn' severe stress scenarios would be unlikely to cause capital to fall to levels that would raise serious concerns about the viability of the system as a whole, though it is possible that the reputation and financial standing of some UK institutions could be affected. This relatively comforting picture is consistent with continued low credit default swap premia for major UK banks (Chart 3.8).

*... though future risk-taking behaviour remains uncertain.*

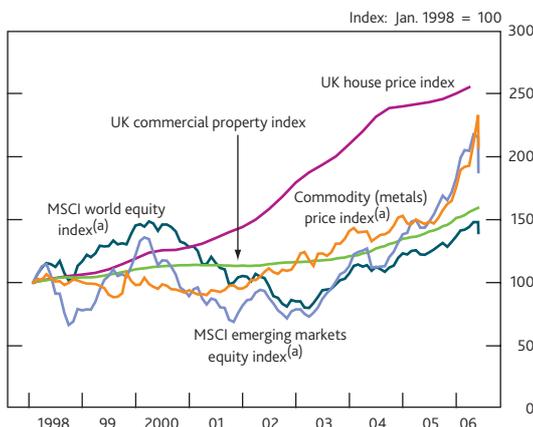
The resilience of the UK financial system in the period ahead will depend on the future behaviour of investors and financial firms. Recent heightened market volatility has reminded investors and firms of the financial risks they are running. But it remains an open question whether it has resulted in a fundamental rethink of risk strategies. On the one hand, there is some evidence recently of greater caution about position-taking among some market participants, with the price of risk having increased. On the other, despite this recent increase, asset prices have not changed to any material extent from six months ago. Previous short-lived episodes of turbulence have, if anything, tended to reinforce perceptions about the stability of the system and have encouraged a return to the risk-seeking environment seen earlier. It is too early to assess whether that pattern will be repeated this time.

*Vulnerabilities in combination could be more material...*

When gauging the future resilience of the UK financial system, it is also important to consider extreme scenarios, even though they are highly unlikely, in which severe shocks cause a number of vulnerabilities to crystallise in combination. Based on developments over the past six months, two such extreme scenarios appear plausible. First, a severe adverse supply-side shock — such as a sudden sharp reduction in the supply of oil, perhaps related to a marked escalation in geopolitical tensions in the Middle East — could prompt a reassessment of the global economic outlook and a sharper-than-expected turn in the global credit cycle. Second, asset prices have risen significantly in recent years (Chart 3.9). Problems might arise if a sudden reversal in perceptions about risk resulted in a substantial further fall in risky asset prices in both the United Kingdom and overseas, at the same time as risk-free interest rates were rising sharply. These scenarios are discussed further in Box 6.

*... with liquidity channels potentially amplifying these effects...*

In severe scenarios, certain structural features of the UK financial system, which have grown in importance in the recent past, could amplify market and credit risks. For example, demand for risky, and prospectively less liquid,

**Chart 3.9** Asset prices

Sources: Bloomberg, Halifax, Nationwide and Thomson Financial Datastream.

- (a) Latest data point based on an average of daily data in June 2006 up to the cut-off date of 26 June.

instruments — including some tranches of structured credit products — has risen in recent years. This may increase the likelihood of a rapid unwind of positions in the event of losses which, owing to the potential illiquidity of the instruments, would then tend to amplify any downward price movements by more than has been the case in the past. This may be more likely if many investors are pursuing similar strategies, as perhaps was illustrated by adjustments in the prices of some of these assets during May and June. And in circumstances where fundamentals appear to have changed, hedge funds might also prove less willing or able to perform a stabilising role in markets than in the past.

On the liabilities side of the balance sheet, UK banks' increased dependence on wholesale funding has heightened their sensitivity to liquidity developments. Increasing linkages within the UK financial system — for example, interbank and counterparty exposures between UK banks and LCFIs — could also amplify the transmission of risk at a system-wide level. These factors would tend to increase correlations between asset returns in a stress scenario, reducing some of the diversification benefits that appear to exist when correlations are low. Again, recent market developments perhaps illustrate such effects.

*...highlighting the need for consideration of extreme stress scenarios in firms' risk management.*

The severe crystallisation of credit, market and liquidity risk in combination could lead to a material erosion of UK banks' capital, with potential knock-on effects to supporting markets, institutions and infrastructures. Illustrative calibrations of stylised severe supply-shock and asset price adjustment scenarios (discussed in Box 6) suggest that losses in either case could be substantial. These estimates are not forecasts for the UK financial system, as scenarios generating such effects are both extreme and highly unlikely. But given their implications, such scenarios merit careful consideration in financial firms' risk management planning.

## Box 6 Systemic stress testing

Stress testing provides a consistent framework for illustrating and measuring how remote tail events might affect financial institutions and the financial system as a whole.<sup>(1)</sup> This box describes how Bank staff are using stress-testing models as an input to the Bank's assessment of the resilience of the UK financial system.<sup>(2)</sup>

The stress-testing approach being developed has four steps:

### Step 1. Identifying systemic vulnerabilities

First, vulnerabilities which could be sources of severe disruption to the UK financial system are identified. A list of potential vulnerabilities is described in the main text.

### Step 2. Constructing stress scenarios

The second step is to identify extreme but plausible stress scenarios in which each of the vulnerabilities crystallise. There are many possible scenarios, varying in likelihood and impact. To shed light on the range of possible impacts, two hypothetical scenarios are examined for each of the vulnerabilities — one a moderate stress event, the other judged to represent more severe stress. The scenarios are selected not because they are likely — they are generally very low probability tail events — but because they provide an illustration of the scale of disturbance that might occur in extreme cases. The stylised scenarios — summarised in Table 1 — are as follows:

#### (i) A correction in low risk premia

These stress scenarios analyse a reversion of risk premia on equities and on high-yield, investment-grade and emerging market bonds to their historical averages, either gradually in the moderate stress scenario, or rapidly with overshooting in the severe case.

#### (ii) An abrupt unwinding of global imbalances

The stylised scenarios consider an abrupt unwinding of global imbalances of varying degrees of severity. In both scenarios, the US dollar is assumed to depreciate significantly, US bond yields to rise and global growth to weaken. Adjustment in the moderate stress scenario is relatively limited, with the US current account deficit falling to around 4.5% of GDP over three years; in the severe stress scenario, it shrinks sharply to 2% of GDP. Credit spreads rise globally as credit quality declines and property and equity prices both fall.

#### (iii) A sharp fall in global corporate credit quality

These stress scenarios consider the impact on corporate finances of a macroeconomic slowdown in the United Kingdom and in overseas markets in which UK banks have significant exposures. The scenarios involve a large adverse

**Table 1** Summary of stress scenarios

Vulnerability	Moderate stress scenario	Severe stress scenario
Low risk premia correction	Risk premia return to their historic average... ...in an orderly way (eg high-yield corporate spreads increase by about 100 basis points to around 400 basis points).	...and rise further (eg high-yield corporate spreads increase by about 400 basis points to around 700 basis points).
Global imbalances unwind	A combined shock to the US dollar, global long rates and US GDP, such that the US current account deficit shrinks to... ...4.5% of GDP over three years. Annual US GDP growth falls to 1.5%; US dollar falls 15%; US long rates rise to about 7%.	...2% of GDP over three years. Annual US GDP growth falls to 0.5%; US dollar falls 30%; US long rates rise to about 8%.
Global corporate stress	A combined supply shock to both the UK and overseas markets, leading to a macroeconomic slowdown and rising inflation... ...UK GDP growth slows to 1%, house prices fall by around 10% and commercial property prices by 20% over three years. Overseas countries experience a shock of similar magnitude.	...UK GDP growth falls to -1.5%, house prices fall by around 25% and commercial property prices by 35% over three years. Overseas countries experience a shock of similar magnitude.
UK household stress	Same supply shock as in global corporate vulnerability (featuring macroeconomic slowdown and rising inflation), but affecting the United Kingdom only.	
LCFI stress	Potential losses on a portfolio of large counterparty exposures to LCFIs with probabilities of default and correlations derived from CDS premia... ...losses above 95th percentile, based on recent CDS spreads.	...losses above 95th percentile, based on CDS spreads in October 2002 and an adjustment to correlation to simulate heightened systemic risk between LCFIs.
Infrastructure disruption	Outage of SWIFT messaging services... ...for one day.	...for two weeks.

supply shock, leading to lower global growth, higher interest rates, falling commercial property prices and rising corporate income gearing. In the moderate stress scenario, the UK corporate liquidation rate and the write-off rate on UK and overseas corporate exposures double. In the severe stress scenario, the UK corporate liquidation rate reaches its early 1990s peak and the write-off rate on UK and overseas exposures trebles.

#### (iv) A marked rise in UK household sector financial distress

These stress scenarios embody a significant adverse supply shock that causes a sharp slowdown in UK growth and a pickup in inflation. The scenarios involve falling UK house prices, rising household distress and increasing defaults and write-off rates. The severe stress scenario is similar to the 1990s UK recession, whereas the moderate scenario is less pronounced.

**(v) LCFI stress**

The LCFI stress scenarios are based on losses arising on a portfolio of large counterparty exposures of UK banks to LCFIs. The scenarios are defined by points on portfolio loss distributions. In the moderate stress scenario, UK banks are assumed to incur expected portfolio losses above the 95th percentile. The loss distribution is defined by a mean probability of LCFI default and a default correlation based on recent credit default swap spreads. In the severe stress scenario, the mean default probability is increased to levels implied by spreads in October 2002, while an upward adjustment is made to the assumed correlation to simulate heightened sensitivity of LCFIs to a common shock.

**(vi) Disruption to SWIFT messaging services**

As an illustrative scenario of the potential impact of a disruption in infrastructure, an outage to SWIFT messaging services is considered. Two specific case studies are examined — a one-day outage and a two-week shutdown. Both scenarios are highly unlikely as these messaging services have never experienced a prolonged disruption and SWIFT has invested heavily in backup sites and systems to recover quickly if problems arise. But they are selected because of their potential widespread impact on the UK financial system due to dependencies on SWIFT.

**Step 3. Mapping transmission channels to banks**

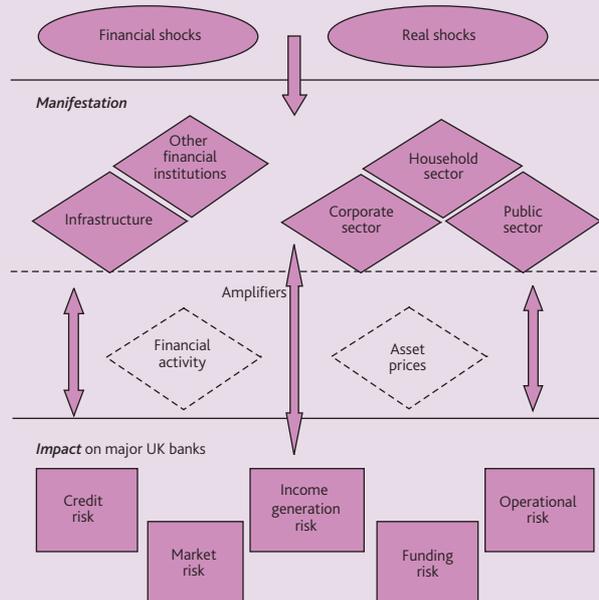
Shocks that trigger vulnerabilities can cause losses for major UK banks in a number of ways. These channels can be illustrated using a stylised ‘risk transmission map’ (Chart A). Shocks may expose vulnerabilities in the balance sheets of financial and/or non-financial counterparties to UK banks — domestically or overseas — leading to credit losses. Shocks (or their impact on borrowers) may also lead to asset price falls, resulting in losses on trading or banking book exposures, and an erosion of collateral values on secured exposures. Banks’ funding costs may rise and a weaker business environment may lower financial activity and so reduce banks’ income.

Banks may respond to an increase in credit write-offs, market losses or a decline in their income by adjusting their behaviour. Although this may aim to mitigate individual bank losses, it could amplify the system-wide impact. For example, a widespread tightening of credit terms might lead to refinancing difficulties, precipitating further credit losses. Or a generalised fall in risk taking might reduce market liquidity, amplifying asset prices falls.

**Step 4. Measuring risk transmission channels**

Quantifying the impact of stress scenarios on the UK financial system is very challenging. In each scenario some possible channels can be quantified using models; others only by making assumptions and judgements because of data and

**Chart A Risk transmission map**



**Table 2 Channels explicitly quantified in stress scenarios<sup>(a)</sup>**

	Low risk premia	Global imbalances	Global corporate debt	UK household debt	LCFI stress	Market infrastructure disruption
<i>Credit risk, exposures to:</i>						
UK households	●	●		●		
UK corporates	●	●	●			
Overseas households	●	●				
Overseas corporates	●	●	●			
<i>Counterparty credit risk, exposures to:</i>						
LCFIs					●	●
Other financial institutions						●
<i>Market risk in trading book</i>						
	●	●				●
<i>Income generation risk</i>						
	●	●	●	●		●
<i>Funding risk</i>						
	●	●	●	●		●
<i>Operational risk</i>						
						●
<i>Macroeconomic feedback effects</i>						
<i>Market liquidity disruption</i>						

(a) A circle denotes that a channel is quantified — fully or partially — in the stress scenario impact estimates.

modelling limitations; and some are not quantified at all. Table 2 shows which channels have been explicitly quantified for each of the stress scenarios. The table illustrates that some channels (such as credit risk) can be quantified reasonably well, whereas others (including the financial market amplification effects discussed in Box 5) may be captured partially but are not explicitly estimated. These missing channels, and the wide uncertainties, need to be borne in mind when interpreting the results of these stress tests.

All impacts are calculated as losses to the major UK banks relative to base profit levels. The metric of UK bank losses is intended to provide a gauge on the potential broader impact on the UK financial system. Losses are calculated over a three-year horizon following the initial shock to give time for effects to feed through to banks' balance sheets.

#### (i) Credit risk

Credit losses are estimated in the corporate, household, low risk premia and global imbalances scenarios using the stress-testing approach described by Bunn *et al* (2005).<sup>(3)</sup> The Bank's macro-forecasting model is used to simulate changes in the economy over a three-year horizon. This forecast is fed into a suite of models for household and corporate balance sheets, which estimate effects on corporate liquidations and on household secured and unsecured arrears. These are then mapped into losses for UK banks, net of recovery through collateral. These models, being based on historical relationships, will not capture structural changes in banks' and borrowers' balance sheets.

#### (ii) Counterparty credit risk

A Basel II style advanced 'internal rating-based' (IRB) approach is used to estimate counterparty losses for UK banks that might arise in the event that one or more LCFI encountered serious problems. An aggregate portfolio of large exposures of UK banks to LCFIs is constructed. The method uses default probabilities and correlations extracted from observed CDS prices to generate an estimate of the average 'tail' losses that UK banks could incur on this portfolio in the event of extreme LCFI stress. These estimates are sensitive to different assumptions about exposure levels, average default probabilities, default correlation and loss given default.

#### (iii) Market risk

Falls in asset prices can generate marked-to-market losses on banks' trading books. In the low risk premia and global imbalances scenarios, proxy estimates of trading book exposures to asset price changes are derived using Value-at-Risk (VaR) disclosures and the volatility of the underlying assets. Losses are then estimated by applying asset price falls to the exposures for different asset classes. These estimates are imperfect measures of exposure to market risk, since the VaR data do not indicate whether a bank is long or short in an asset. Market risk in the trading book is therefore imperfectly captured.<sup>(4)</sup>

#### (iv) Income generation risk

Net interest is the UK banks' largest single source of income and may fall in a weaker economic environment. This effect is captured using an estimated equation that relates net interest income to real GDP growth (see Bunn *et al* (2005)). Estimates are also made of potential falls in other sources of banks' income, such as fees.

#### (v) Funding risk

UK banks may face a reduction in the availability of funding and an increase in its price in stressed circumstances. For example, funding costs could rise if banks suffer downgrades in their credit ratings due to losses incurred. A simple approach is used to capture these costs in the corporate, household, global imbalances and low risk premia stress scenarios. This is based on case studies of previous episodes when banks were downgraded and the effect this had on their funding costs. In several of the moderate stress scenarios, banks' losses from other channels are judged to be too low to trigger an increase in funding costs.

#### (vi) Operational risks

Operational risks are likely to be a key channel in any infrastructural disruption, including the SWIFT outage scenarios considered as a case study. In these scenarios, possible impacts on UK banks have been estimated using firms' responses to the FSA Resilience Benchmarking survey (2005)<sup>(5)</sup> that included estimates of the costs, claims and charges likely to arise in the event of key wholesale market functions being disabled. These figures also include a funding risk element. In the estimates shown, some allowance is made for additional channels that could be activated, including counterparty credit risk on increased exposures to other banks and from possible settlement delays. Estimates of trading risk from heightened market volatility are derived from banks' VaR disclosures, and possible losses of income are based on data on banks' dealing profits. Uncertainties around the impact of a long outage include the possibility that daily costs may build up over time, perhaps as business delays mount, or may diminish as workarounds are found.

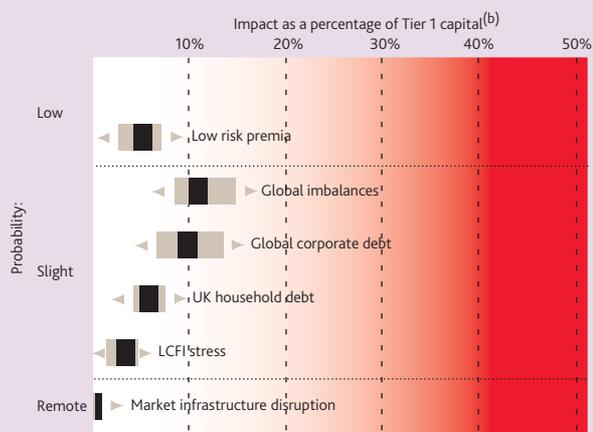
#### (vii) Other channels

A number of other channels that may be important in times of stress — particularly for some vulnerability scenarios — are not quantified fully or in some cases at all. These include sharp falls in market liquidity or disrupted market functioning, as well as possible feedback effects between the financial system and the macroeconomy. For expositional purposes, banks are assumed not to respond to the shock scenarios by adjusting their balance sheets, pricing or other behaviour. It is also assumed that monetary policy follows a mechanical Taylor rule at all times.<sup>(6)</sup> These assumptions generate an additional source of uncertainty around the impact estimates, on top of uncertainties around the channels that are quantified in the scenarios.

#### Quantifying impact in vulnerability scenarios

Chart B shows some preliminary, illustrative estimates of the potential losses — relative to base profit levels — that could arise for the major UK banks over a three-year horizon in each of the moderate stress scenarios. Chart C reports results for the severe stress scenarios. The reported losses are scaled by the Tier 1 capital of the major UK banks although, importantly

**Chart B** Impact and likelihood of 'moderate stress scenarios' affecting vulnerabilities<sup>(a)</sup>



Source: Bank calculations.

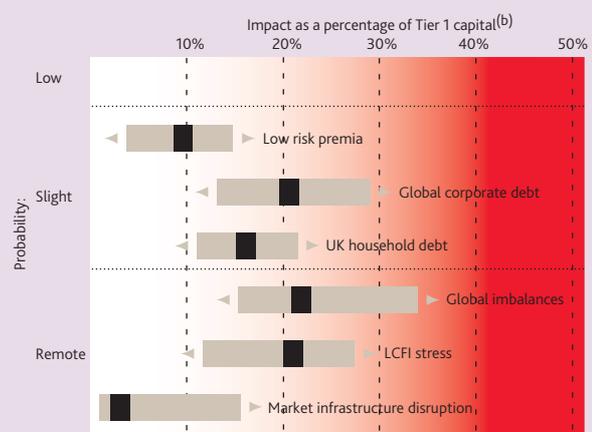
- (a) Central band shows best current quantified estimate of scale of loss under each scenario; wider bands include allowances for some uncertainties around these calibrations. A number of potential channels are not included in the bands.  
 (b) Total impact for major UK banks of individual scenarios over a three-year horizon, relative to base. The impact is expressed as a percentage of current Tier 1 capital but, given UK banks' current profits, does not necessarily imply a loss of capital.

given the additional buffer provided by banks' current profits, that does not imply that capital would necessarily be eroded. Central estimates of these losses are indicated by darker bands, with the lighter bands making some allowance for the uncertainties around these calibrations. The potential for other impacts from currently unquantified channels, which may lead to additional losses or may mitigate the impact, is indicated by the arrows. The impact estimates are partial and uncertain, so are not strictly comparable across the vulnerability scenarios. And the time profile of losses is likely to vary across scenarios, as discussed in the main text.

The charts also show a preliminary judgement on the likelihood of these alternative scenarios, with each vulnerability scenario placed in one of three probability ranges — low, slight and remote. The likelihood of any specific scenario occurring is close to zero. So the probabilities are broad judgements on the chance of a comparable event occurring. Most of the moderate stress scenarios are judged to be slight possibilities, while a number of the severe stress scenarios are judged to be remote.

Taking each of the vulnerabilities in turn, the likelihood of a moderate correction in risk premia is judged to be greater than for the other vulnerabilities, but the estimated impact is relatively modest. Losses in a more severe scenario, involving some overshooting of risk premia, are more material. Calibrated losses are equivalent to some 5%–15% of UK banks' Tier 1 capital. Several potentially important channels of impact — such as losses on counterparty credit exposures and potential market liquidity disruption — are not fully captured by these calibrations.

**Chart C** Impact and likelihood of 'severe stress scenarios' affecting vulnerabilities<sup>(a)</sup>



Source: Bank calculations.

- (a) Central band shows best current quantified estimate of scale of loss under each scenario; wider bands include allowances for some uncertainties around these calibrations. A number of potential channels are not included in the bands.  
 (b) Total impact for major UK banks of individual scenarios over a three-year horizon, relative to base. The impact is expressed as a percentage of current Tier 1 capital but, given UK banks' current profits, does not necessarily imply a loss of capital.

An abrupt unwinding of global imbalances is unlikely. But Bank staff calibrations suggest it could generate significant losses for major UK banks, with rough calibrations equivalent to 15%–35% of UK banks' Tier 1 capital in a remote severe stress scenario.

Estimated losses for UK banks in a scenario where global corporate credit quality falls sharply are also material — in the extreme, but unlikely, severe stress scenario they are equivalent to 15%–30% of Tier 1 capital. Write-offs on domestic and overseas credit exposures account for the bulk of these losses. Uncertainties around the estimates are substantial, however, not least given the paucity of data on the scale of UK banks' overseas corporate exposures.

Estimated losses arising from the UK household sector stress scenario are relatively small, except in the unlikely event of a severe macroeconomic downturn. In the severe stress scenario, estimated losses are equivalent to 10%–20% of Tier 1 capital. Because they are based on historical relationships, these calibrations take no account of any potential recent structural change in households' or banks' behaviour.

Severe stress at one or more LCFIs is unlikely, but could have a significant impact on major UK banks. It is impossible to quantify the impact with any precision. Relevant factors would include which LCFI (or LCFIs) was in difficulty, the underlying cause of the distress, the timing and speed with which problems unfolded and the exposures and activities affected. The responses of other market participants would be critical. The estimates of losses in a remote scenario that involves severe stress across a number of LCFIs are equivalent to 10%–30% of Tier 1 capital. These are estimates of the

losses to UK banks that might arise from direct counterparty exposures to LCFIs in distress. Several other potential transmission channels — for example, arising from wider credit losses, asset prices falls and financial market disruption — are not fully captured by these calibrations.

As an illustration of the potential impact of disruption to market infrastructure, scenarios are considered in which there are outages of SWIFT messaging services. These scenarios are all very remote possibilities. The best estimate of losses is quite modest, but there is considerable upside uncertainty about impact. These uncertainties mean that calibrated losses could be equivalent to up to 15% of Tier 1 capital, even though the central estimate is much lower. These estimates do not include wider losses to the UK financial system — for example, through potential market dislocation.

### Generalised stress scenarios

In practice, one or more of the key vulnerabilities could be exposed simultaneously (if triggered by a common shock) or sequentially (if one vulnerability knocks onto another). Conducting stress tests for generalised stress scenarios involves the same steps and the same types of uncertainty described for the individual vulnerabilities. But some of the simplifying assumptions about the absence of behavioural changes are likely to be more questionable in these broader scenarios, given their potentially greater impact. Nonetheless, stress scenarios that involve shocks affecting several vulnerabilities simultaneously provide some guide to the potential impact of such events. Two such scenarios are considered:

#### (i) A large adverse supply-side shock

This stress scenario is a stylised severe adverse supply-side shock to the global economy, which results in a broad-based slowdown in real activity and higher inflation and interest rates. The stress scenario represents a global economic slowdown that is calibrated to resemble, in terms of severity, the early 1990s UK recession. The channels through which the global shock propagates are common to the global corporate and household vulnerability scenarios and are quantified using the same approach as described in Step 4. The severe recession triggers losses for UK banks as write-off rates on household and corporate debt rise in the United Kingdom and overseas. The slowdown in economic activity reduces banks'

net interest income. As a result of these losses, banks' creditworthiness falls and their funding costs rise.

#### (ii) Sharp, widespread rises in global interest rates and risk premia

This scenario involves a sharp increase in long-term interest rates and risk premia in the United Kingdom, the United States and the euro area. Output growth falls alongside asset prices. So, for example, nominal UK long rates are modelled to increase by around 150 basis points, the spread on high-yield corporate bonds rises by around 500 basis points and UK GDP falls by about 2% relative to base. These developments trigger a number of the vulnerabilities, particularly the low risk premia, household and corporate debt vulnerabilities. Losses crystallise through a range of channels, including trading losses, rises in credit write-offs on corporate and household exposures, higher funding costs and income losses.

Illustrative calibrations of these broad severe stress scenarios suggest that losses in either case could be equivalent to around 30%–40% of major UK banks' Tier 1 capital.

### Limitations of the stress-testing approach

Modelling the impact of stress scenarios on banks is complex. There are many uncertainties around the quantitative results. Some derive from using models based on historical relationships, which may have changed or may not hold in stress events. Others reflect simplifying assumptions about the behaviour of borrowers, banks and policymakers. Potential feedbacks through asset markets or changes in banks' lending behaviour, which may be substantial, are not modelled explicitly at present. Data availability is also a significant problem when quantifying some of the channels in the transmission map.

The model-based estimates presented in this *Report* are illustrative of the approach that the Bank is developing to assess quantitatively the relative importance of different vulnerabilities in the UK financial system, but they are preliminary and partial. The value of these stress tests is in providing a consistent framework for understanding risks and identifying key questions and vulnerabilities requiring further analysis. As such, at present they represent one contribution to the Bank's overall judgement on prospects for financial stability.

(1) Section 4 discusses the key role that stress testing plays in risk management at individual institutions.

(2) The Bank plans to publish a fuller account of this stress-testing approach later this year.

(3) Bunn, P, Cunningham, A and Drehmann, M (2005), 'Stress testing as a tool for assessing systemic risks', Bank of England *Financial Stability Review*, June, pages 116–26.

(4) With the exception of the trading book, the impact of stress scenarios on the overall economic value of banks is not measured.

(5) FSA (2005), *Resilience Benchmarking Project Discussion Paper*, December.

(6) Under the Taylor rule, the level of interest rates depends on the rate of inflation relative to its target and the level of output relative to trend.

## Box 7 Risk transmission in the Russian and LTCM crises

The risk assessment approach used by the Bank in this *Report* can be illustrated by reference to the Russian and Long-Term Capital Management (LTCM) crises in 1998. Figure A shows the key propagation channels during this crisis. The initial shock was the Russian authorities' decision in mid-August 1998 unilaterally to restructure their domestic currency government debt (line 1 in Figure A). The default led to a currency crisis — the rouble fell by more than 60% in August — and a banking crisis as Russian banks made heavy losses on holdings of government bonds, while simultaneously their net foreign currency liabilities increased significantly.<sup>(1)</sup>

The crisis had a large impact on global financial stability despite the quite limited direct exposures of international banks to Russia (line 2).<sup>(2)</sup> Exposures of BIS banks as a whole were only about 3% of their total foreign claims. Instead, the default was propagated to international banks mainly indirectly through its impact on global capital markets. The crisis led to a generalised reassessment of credit risk in emerging and mature markets. This resulted in a flight to quality — while spreads and yields on risky debt increased sharply, yields on US Treasury bonds fell (line 3). The second indirect channel was the reaction of international banks and other large financial institutions (line 4). Some firms chose to reduce riskier asset positions while others were forced to do

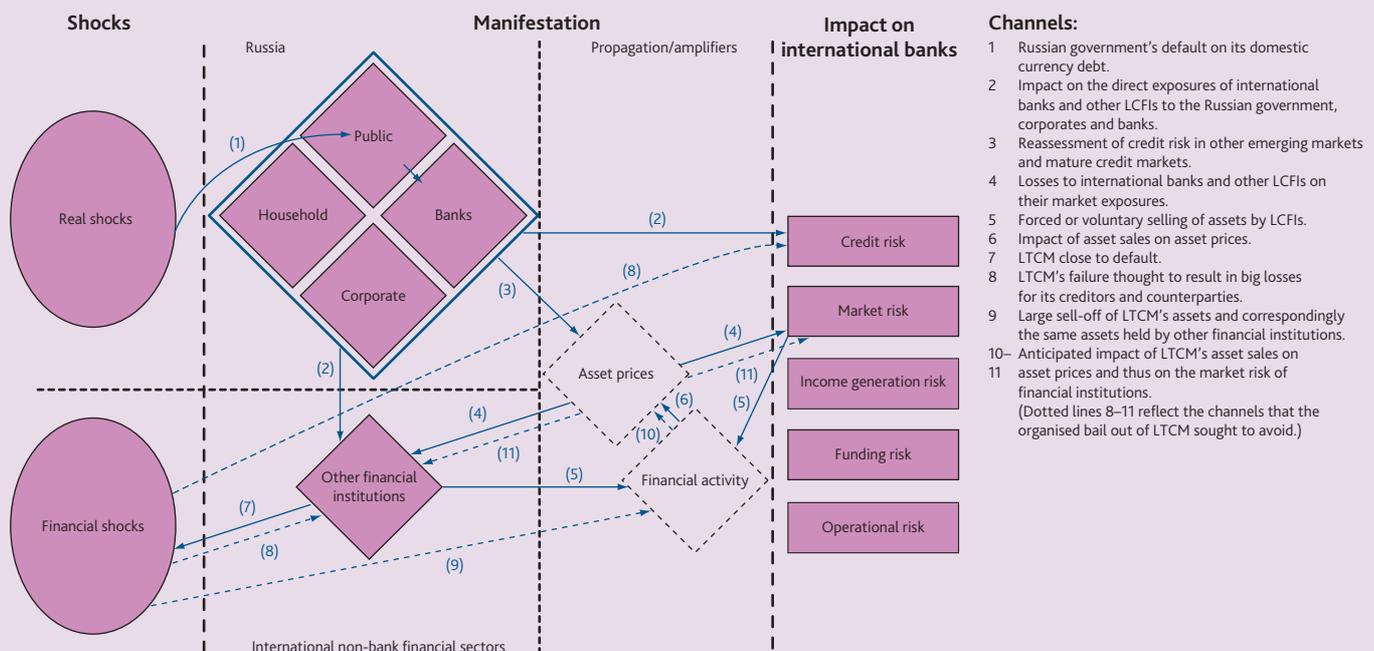
so.<sup>(3)</sup> Margin calls from creditors forced highly leveraged institutions to sell assets (line 5).

Internal margin calls were also made on the proprietary desks of investment banks. That increased market price volatility and led to automatic selling by investors, many of whom were using the same trading models and were investing in similar assets. This accentuated falls in asset prices (line 6).

Market turbulence heightened in early September on rumours that LTCM was facing insolvency and that other institutions (including some of LTCM's major creditors and counterparties) might be in a similar position (line 7).<sup>(4)</sup> The crisis culminated in late September with the Federal Reserve Bank of New York facilitating discussions among LTCM's major creditors, counterparties and investors, which led to a \$3.6 billion private sector rescue of LTCM. There were two systemic concerns about an immediate closure of LTCM. First, it might have impaired the already fragile financial position of some of LTCM's creditors and counterparties (line 8). Second, and more importantly, it might have weakened LCFIs not directly involved with LTCM due to falls in asset prices following the fire sale of LTCM's assets by its creditors (lines 9 to 11).

This illustration highlights the need to consider a wide range of possible crisis propagation channels. In addition, while data transparency of major financial institutions has improved in recent years, the growing role of new participants and the growth in complex new instruments mean that data-driven risk analysis needs to be complemented by market intelligence.

**Figure A** Risk transmission map: Russian default (August) and LTCM near-failure (September 1998)



(1) See De Paoli, B, Hoggarth, G and Saporta, V (2006), 'Costs of sovereign default', *Bank of England Financial Stability Paper no. 1*, on the broader costs of sovereign crises, available at [www.bankofengland.co.uk/publications/fsr/fs\\_paper01.pdf](http://www.bankofengland.co.uk/publications/fsr/fs_paper01.pdf).

(2) Some other financial institutions had larger concentrations of exposures.

(3) Indeed, Salomon Smith Barney's earlier decision to close its US bond arbitrage operation is an example of how dealer exit can materially affect less liquid markets.

(4) By early September LTCM had used half of its capital on margin calls, mainly on its exposures to mature markets.

# 4 Mitigating risks to the UK financial system

Private sector risk management has improved significantly over the past decade as a result of a sequence of private and public sector initiatives. The Bank's assessment indicates a number of areas where management of risks to the financial system may need further attention, in particular: liquidity risk; aggregate economic and financial risk; risk aggregation within and across firms; and contingency planning. This section discusses work that is under way and new work that might need to be undertaken by the private sector and the public authorities to address these gaps.

**Table 4.A** Recent initiatives to improve financial sector risk management<sup>(a)</sup>

	Led by:	
	Private sector	Official sector
Completion of Basel II framework <sup>(b)</sup>		●
Counterparty Risk Management Policy Group II report <sup>(c)</sup>	●	
Bank of England Money Market Reform <sup>(d)</sup>		●
Stress-testing initiatives <sup>(e)</sup>	●	●
New framework for IMF surveillance <sup>(f)</sup>		●
Revision of HMT/FSA/Bank MoU <sup>(g)</sup>		●
Financial crisis management processes <sup>(h)</sup>		●
Business continuity exercises <sup>(i)</sup>	●	●
OTC derivatives post-trade processing initiatives <sup>(j)</sup>	●	●

Source: Bank of England.

(a) Initiatives completed in the past year or ongoing.

(b) [www.bis.org/publ/bcbs118.htm](http://www.bis.org/publ/bcbs118.htm).

(c) [www.crmgroup.org/docs/CRMPG-II.pdf](http://www.crmgroup.org/docs/CRMPG-II.pdf).

(d) [www.bankofengland.co.uk/markets/moneymarketreform/index.htm](http://www.bankofengland.co.uk/markets/moneymarketreform/index.htm).

(e) [www.fsa.gov.uk/pubs/discussion/dp05\\_02.pdf](http://www.fsa.gov.uk/pubs/discussion/dp05_02.pdf) and [www.crmgroup.org/docs/CRMPG-II.pdf](http://www.crmgroup.org/docs/CRMPG-II.pdf).

(f) [www.imf.org/external/np/pp/eng/2006/040506.pdf](http://www.imf.org/external/np/pp/eng/2006/040506.pdf) and

[www.imf.org/external/np/sec/pr/2006/pr0681.htm](http://www.imf.org/external/np/sec/pr/2006/pr0681.htm).

(g) [www.bankofengland.co.uk/financialstability/mou.pdf](http://www.bankofengland.co.uk/financialstability/mou.pdf).

(h) [www.bankofengland.co.uk/publications/other/financialstability/briefing\\_051209.pdf](http://www.bankofengland.co.uk/publications/other/financialstability/briefing_051209.pdf).

(i) [www.fsc.gov.uk](http://www.fsc.gov.uk).

(j) [www.newyorkfed.org/newsevents/news/markets/2005/an050915.html](http://www.newyorkfed.org/newsevents/news/markets/2005/an050915.html),

[www.newyorkfed.org/newsevents/news/markets/2006/an060216.html](http://www.newyorkfed.org/newsevents/news/markets/2006/an060216.html) and

[www.bis.org/press/p060213b.htm](http://www.bis.org/press/p060213b.htm). These initiatives are discussed in Section 2.

Responsibility for mitigating risks to the UK financial system is shared between the private sector and the public authorities — HM Treasury (HMT), the Financial Services Authority (FSA) and the Bank of England. Over recent years, a sequence of initiatives has resulted in significant improvements to risk management practices within the private sector. Table 4.A presents a summary of some recent initiatives.

The revision of the Basel capital accord — Basel II — has been led by the official sector, but has involved an intensive programme of work for both the public and private sectors over the past decade.<sup>(1)</sup> The Basel II framework has been agreed and implementation in the European Union is planned to start in 2007–08. Preparation for the new bank capital standards has itself helped promote best practice in modelling and measuring credit risk, both within the private sector and among supervisory agencies.<sup>(2)</sup> On the private sector side, the second report of the Counterparty Risk Management Policy Group (CRMPG) was published in July 2005,<sup>(3)</sup> following up their earlier report in 1999. This established a set of detailed recommendations and guiding principles for improving risk management and monitoring in the private sector. It highlighted a number of priority areas, including back-office problems in over-the-counter (OTC) derivatives markets,

(1) Basel Committee on Banking Supervision (2005), 'International convergence of capital measurement and capital standards: a revised framework', November. Available at [www.bis.org/publ/bcbs118.htm](http://www.bis.org/publ/bcbs118.htm).

(2) See Schmidt Bies, S (2006), 'A risk-management perspective on recent regulatory proposals', 10 April. Available at [www.bis.org/review/r060419d.pdf](http://www.bis.org/review/r060419d.pdf).

(3) 'Toward greater financial stability: a private sector perspective'. Available at [www.crmgroup.org/](http://www.crmgroup.org/).

particularly for credit products (discussed in Section 2). Subsequent credit events have underlined a number of the issues raised in the report, such as the methodologies to be applied in the settlement of contractual obligations.

Despite clear examples of progress, the Bank's assessment points to a number of areas where risk management and planning might usefully be improved further. These can be divided into four categories:

- liquidity risk;
- aggregate economic and financial risk;
- risk aggregation within and across firms; and
- contingency planning.

## 4.1 Managing liquidity risk

Understanding, modelling and hence pricing liquidity risk is more difficult — and as a result less advanced — than for, say, market and credit risk because of the complexity and unpredictability of the interactions which may arise. As highlighted in Section 2 of this *Report*, two structural developments suggest that liquidity risk is becoming relatively more important over time to financial intermediaries and so to the UK financial system as a whole. First, the build-up in exposures of some financial counterparties to more complex, and in some cases less liquid, instruments — affecting so-called market liquidity risk. Second, the increasing reliance by UK banks on wholesale funding — raising so-called funding liquidity risk.

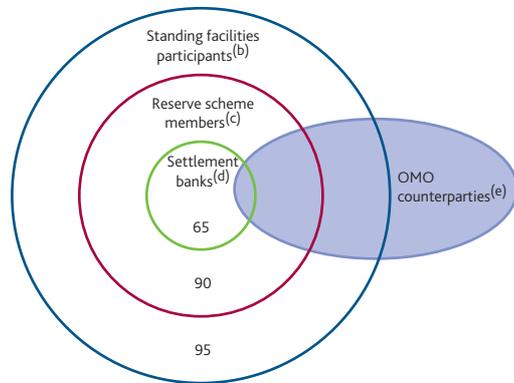
### *Bank of England sterling money market operations have been reformed...*

From the official sector side, several initiatives have been undertaken or are under way which would help mitigate these risks. In the United Kingdom, fundamental reforms to the Bank's operations in the sterling money markets were introduced on 18 May.<sup>(1)</sup> These reforms have increased the number of counterparties able to access sterling liquidity directly from the Bank, from around 20 prior to the reforms to over 50 afterwards. The system allows members to vary their balances at the Bank from day to day, provided that they meet their average target over the periods between the MPC's monthly interest rate decisions and that balances remain positive at the end of each day. This should provide the banking system with greater flexibility in the day-to-day management of liquidity. In addition, the vast majority of the UK banking system — accounting for 95% of eligible liabilities<sup>(2)</sup> — is now able to borrow directly from, or deposit

(1) See 'The framework for the Bank of England's operations in the sterling money markets', (the 'Red Book'), May 2006. Available at [www.bankofengland.co.uk/publications/news/2006/055.htm](http://www.bankofengland.co.uk/publications/news/2006/055.htm). See also 'A banking system worthy of the City's markets', Paul Tucker, *Financial Times*, 15 May 2006.

(2) Sterling eligible liabilities broadly comprise sterling deposits (deducting deposits placed with other banks and building societies).

Chart 4.1 Access to the Bank's facilities<sup>(a)</sup>



Source: Bank of England.

- (a) Per cent of eligible banking system liabilities covered by participating firms, as at the time of launch of sterling money market reforms. Eligible liabilities broadly comprise sterling deposits, deducting deposits placed with other banks and building societies.
- (b) Can have access to standing facilities only.
- (c) All must have access to standing facilities.
- (d) Automatically reserve participants.
- (e) Can be an open market operations (OMO) counterparty only. Open to non-cash ratio deposit-paying banks, building societies and securities dealers that are active intermediaries in the sterling markets. Under the Cash Ratio Deposit (CRD) scheme, certain institutions authorised to accept deposits under the Financial Services and Markets Act 2000 (banks and building societies) are obliged under Schedule 2 of the Bank of England Act 1998 to place non-interest bearing deposits (CRDs) with the Bank of England.

money with, the Bank through standing facilities, in unlimited amounts against eligible collateral on the borrowing side (Chart 4.1). This should lessen the risk of liquidity bottlenecks arising within the private sector, which are more prevalent in times of market stress.

In the event of major operational or financial disruption to the sterling money markets or their supporting infrastructure, the money markets may effectively be closed. In those circumstances, the Bank would be able to narrow the spread between the lending and deposit facility around the Bank rate, if necessary to zero, to facilitate the provision of liquidity to the market.

These reforms have also had the side-effect of encouraging a greater number of UK-operating banks to join the UK high-value payment system, CHAPS. Abbey joined in November 2005, UBS has announced plans to do so next year and several others are considering the case. Increased membership of CHAPS reduces intraday unsecured interbank credit exposures in the system, and the associated risks.<sup>(1)</sup>

This sequence of reforms is intended to introduce greater resilience to sterling markets and institutions, by encouraging prudent liquidity management by participants in normal conditions together with greater flexibility of liquidity provision and management during periods of stress.

#### ...alongside initiatives to improve liquidity management internationally...

In parallel with these domestic initiatives, work is under way internationally on liquidity management issues. The Bank participated, alongside the FSA, in the recently published study of liquidity risk management in financial groups conducted by the Joint Forum.<sup>(2)</sup> This study highlighted that, in a crisis, most banks would seek to manage liquidity on a more centralised basis than in normal market conditions. That would involve moving funds across borders and/or between affiliates.

In that regard, a parallel study by the G10 Committee on Payment and Settlement Systems<sup>(3)</sup> (CPSS), in which the Bank also participated, examined whether arrangements to facilitate the cross-border movement of collateral used to back central bank credit provision were adequate. The study found that, while no new infrastructure would necessarily be required, increased co-ordination between central banks would improve the effectiveness of existing arrangements.<sup>(4)</sup> The CPSS report

(1) See the Bank of England *Financial Stability Review*, December 2005: Themes and Issues. Available at [www.bankofengland.co.uk/publications/fsr/index.htm](http://www.bankofengland.co.uk/publications/fsr/index.htm).

(2) The Joint Forum is an international group of supervisors of firms in the banking, securities and insurance sectors. See [www.bis.org/publ/joint16.pdf](http://www.bis.org/publ/joint16.pdf).

(3) Cross-border collateral arrangements, January 2006. Available at [www.bis.org/publ/cpss71.htm](http://www.bis.org/publ/cpss71.htm).

(4) The liquidity risk implications of increased cross-border collateral use are explained in Manning, M and Willison, M (2006), 'Modelling the cross-border use of collateral in payment systems', *Bank of England Working Paper no. 286*.

**Table 4.B** Existing cross-border collateral linkages<sup>(a)</sup>

Collateral accepted by:	Collateral denominated in:						
	Canadian dollar	Euro	Yen	Swedish krona	Swiss franc	Sterling	US dollar
Canada							
Euro area <sup>(b)</sup>							
Japan							
Sweden <sup>(c)</sup>							
Switzerland							
United Kingdom <sup>(d)</sup>							
United States <sup>(e)</sup>							

Source: BIS, Committee on Payment and Settlement Systems, Cross-border collateral arrangements, January 2006.

(a) This table maps the use of collateral denominated in the currencies in the columns (collateral denominated in:) to secure central bank lending in economies in the rows (collateral accepted by:).

(b) There is also extensive cross-border use of collateral within the euro system, but with only euro-denominated securities eligible.

(c) The Swedish Riksbank also accepts Danish and Norwegian krona cash, using the Scandinavian cash pool.

(d) The Bank of England accepts US Treasury bonds only in exceptional circumstances (see *The Framework for the Bank of England's Operations in the Sterling Money Markets*, page 24, Contingencies).

(e) Refers to collateral backing Discount Window lending.

also encouraged central banks to consider expanding their eligible collateral lists to include a wider range of foreign securities, at least in times of stress. For instance, the Bank of England routinely accepts euro-denominated securities and will also accept US Treasuries in exceptional circumstances (Table 4.B).

In addition to improving central banks' management of liquidity and collateral, further analysis is warranted on the case for improving liquidity standards. Existing national standards may need to be reappraised in the light of structural developments, such as increased use of foreign currency funding and off balance sheet products. More fundamentally, given the increasingly cross-border nature of financial activity, it may make sense to seek a greater degree of consistency in the objectives of liquidity standards across jurisdictions.<sup>(1)</sup>

### ...with liquidity stress testing by firms a priority.

Alongside these official sector initiatives, there is clearly further scope for improving private sector financial firms' testing of liquidity risk.<sup>(2)</sup> On the funding side, for example, the Joint Forum found that only one third of surveyed banks test the impact of a firm-specific event — such as a ratings downgrade — within an unsettled market environment, with some two thirds simulating the two separately. On the market liquidity side, given the growing importance of complex and structured products whose liquidity characteristics in stressed market conditions are uncertain, stress testing may need to be given greater priority by financial firms and regulatory agencies in the period ahead. Those stress tests could usefully include the impact on liquidity risk of dealer exit from key markets under stressed conditions.

## 4.2 Managing aggregate risk

As Section 1 discussed, there are indications that perceptions of aggregate economic and financial risk may have increased in recent months. That highlights the importance of stress testing to assess the impact of plausible but severe macroeconomic events on banks' balance sheets.

### *Firm-level stress testing of severe economic scenarios should be assessed...*

In recent years, UK and other firms have improved the testing of their resilience against different stress scenarios as part of their Basel II preparations. It is important that the scope and methods used meet three tests.

First, it is important that the chosen stress scenarios do not overly extrapolate from the macroeconomic stability

(1) Large, A (2005), 'Financial stability: managing liquidity risk in a global system', Bank of England *Financial Stability Review*, December. Available at [www.bankofengland.co.uk/publications/fsr/2005/fsrfull0512.pdf](http://www.bankofengland.co.uk/publications/fsr/2005/fsrfull0512.pdf).

(2) See, for example, 'Stress testing', *FSA Discussion Paper no. 05/2*. Available at [www.fsa.gov.uk/pubs/discussion/dp05\\_02.pdf](http://www.fsa.gov.uk/pubs/discussion/dp05_02.pdf).

experienced in the United Kingdom and globally over the past ten years.<sup>(1)</sup> Second, these scenarios need to be internally consistent in terms of how macroeconomic variables behave and interact. Third, it is important that the results of these stress tests are both seen and acted on by firms' senior management. Stress testing should contribute importantly to the setting of firms' risk appetite.

The FSA is currently undertaking a survey of UK firms' stress-testing practices as part of a campaign to identify good practice in the industry. The Bank believes there could, in due course, be some value in using a common set of scenarios as inputs to firms' risk models, in addition to those particular scenarios that firms should individually consider given their exposures. That would facilitate cross-firm comparability of risk profiles. More generally, the publication of firms' stress-test results might be a useful tool for enhancing market transparency and discipline.

*...and the prospective 'procyclicality' of Basel II monitored...*

There is a related, but distinct, dimension to aggregate risk arising from the prospective introduction of Basel II capital requirements. Were these to bite, they might exacerbate a cyclical downturn by amplifying the contraction in credit. Quantitative work has been undertaken to gauge the potential scale of the 'cyclicality' of Basel II capital requirements and suggests it may be significant.<sup>(2)</sup> It will be important to closely monitor this effect once Basel II is in operation, as recognised by the Basel Committee.

*...though multilateral surveillance and consultation on global economic risks may help reduce risk over time.*

At the IMF's spring meetings in April, G7 Ministers and Governors and the IMF's International Monetary and Financial Committee (IMFC) agreed that the IMF's surveillance of the global economy should be strengthened.<sup>(3)</sup> The IMFC identified a number of reforms that could support this objective, including greater focus on multilateral issues in its surveillance and the development of new procedures to facilitate multilateral consultations about particular risks facing the global economy. These will begin with a focus on the orderly unwinding of global imbalances.<sup>(4)</sup> These reforms could, over time, lead to policies that reduce aggregate risk in the international financial system.

### 4.3 Managing aggregation risk

There are two dimensions to this risk — interdependencies between risks on individual firms' balance sheets and

(1) See also the Governor's speech at the CBI North East Annual Dinner, 11 October 2005. Available at [www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf](http://www.bankofengland.co.uk/publications/speeches/2005/speech256.pdf).

(2) Kashyap, A and Stein, J (2004), 'Cyclical implications of Basel II capital standards', *Economic Perspectives*, Q1, pages 18–31, Federal Reserve Bank of Chicago. See also Nier, E and Zicchino, L (2005), 'Bank weakness and bank loan supply', Bank of England *Financial Stability Review*, December, pages 85–93.

(3) See [www.imf.org/external/np/sec/pr/2006/pr0681.htm](http://www.imf.org/external/np/sec/pr/2006/pr0681.htm).

(4) See [www.imf.org/external/np/sec/pr/2006/pr06118.htm](http://www.imf.org/external/np/sec/pr/2006/pr06118.htm).

interdependencies between firms themselves which might give rise to unforeseen risks for the system as a whole. There are challenges to risk aggregation and management in both dimensions. As Sections 1 and 2 highlighted, financial innovation and integration has tended to increase the scale of both risks recently.

#### *Aggregating across risks on firms' balance sheets...*

From a risk management perspective, there is clearly a need to look at balance sheet risks in an integrated fashion. That is easier said than done. As discussed in Section 3, credit, market and liquidity risk may become highly interdependent during periods of severe market stress.<sup>(1)</sup> And surveys have highlighted integrated stress testing as a key challenge.<sup>(2)</sup> Measuring linkages between risk types, in both normal and stressed situations, should be an important ingredient of firms' testing and is clearly a priority area for further work by firms and supervisory agencies. For firms, that could usefully include a consideration of whether, in stressed circumstances, risks previously thought to have been distributed off balance sheet might return to them due to the terms of the financial contract. One example of this is where banks have sold illiquid instruments to, and provided finance for, hedge funds who are subsequently forced to sell back the asset because of a fall in its value, or to return it in the event of default as realised collateral.

#### *...and aggregating across firms within the system.*

If anything, the gap in understanding and managing cross-firm interdependencies, and their implications for systemic risk, is even larger. A first line of defence against such risks is effective counterparty risk management by firms. Reports by the Bank for International Settlements, and more recently the CRMPG, provide a good road-map of best practices in this field.<sup>(3)</sup> One recommendation made by the latter report was that credit providers obtain adequate information from counterparties on contingencies that might affect their credit quality.

In the area of stress testing, firms could usefully give consideration to the likely response of other financial intermediaries. Firm-level practices are, however, unlikely to insure the system as a whole effectively given that, individually, firms may lack the incentives or tools to factor system-wide risks fully into their stress testing. Cross-system simulations and tests are needed to gauge fully system-wide risks.

(1) See also Drehmann, M, Sorensen, S and Stringa, M (2006), 'Integrating credit and interest rate risk: a theoretical framework and an application to banks' balance sheets'. Available at [www.bis.org/bcbs/events/rtf06rmregcftp.htm](http://www.bis.org/bcbs/events/rtf06rmregcftp.htm).

(2) Committee on the Global Financial System (2005), 'Stress testing at major financial institutions: survey results and practice', January. Available at [www.bis.org/publ/cgfs24.htm](http://www.bis.org/publ/cgfs24.htm). See also [www.fsa.gov.uk/pubs/discussion/dp05\\_02.pdf](http://www.fsa.gov.uk/pubs/discussion/dp05_02.pdf).

(3) See [www.bis.org/publ/joint13.pdf](http://www.bis.org/publ/joint13.pdf), [www.bis.org/publ/bcbs46.htm](http://www.bis.org/publ/bcbs46.htm) and [www.crmppolicygroup.org/](http://www.crmppolicygroup.org/).

Some simulations have been undertaken at the Bank, calibrated to UK data, in an attempt to assess these risks.<sup>(1)</sup> But there is considerable scope for refining and updating these simulations, as risks are likely to change as new sources of interdependence arise — for example, from the rapid growth of credit derivatives. The Bank is looking to develop a suite of models to understand and quantify these interdependencies better.

## 4.4 Contingency planning

Two of the key vulnerabilities identified in Section 3 arise from the adverse consequences of an individual stress event within the financial system — either at a market infrastructure or a large complex financial institution. Given the potential impact on the UK financial system, actions to limit the impact of either such event are clearly important for both the public authorities and the private sector.

### *UK contingency plans for managing a financial crisis...*

Recently, the UK authorities have put significant effort into re-examining and improving their processes for managing a financial crisis, deriving either from a financial event or from operational disruption affecting business continuity. Box 8 describes how risk assessment work may help inform such financial crisis management planning.

One aspect is how each UK authority discharges its responsibilities and how co-ordination between the three authorities takes place during a crisis. New procedures have been agreed over the past year and are reflected in a revised MoU.<sup>(2)</sup> These procedures have been informed by tests and discussion over the past couple of years, including studies of past crises such as the failure of Barings in 1995. Another UK official-sector financial crisis management exercise is likely to take place during 2007, to test and improve those processes further.

Managing the impact of the failure of a major global financial institution would require significant cross-border co-ordination. Recent initiatives to develop crisis-specific co-ordination networks include a MoU among EU central banks, regulators and finance ministries.<sup>(3)</sup> Later this year, the UK authorities and the Financial Stability Forum will jointly host a workshop for national authorities to share experiences in planning for both financial crises and business continuity incidents, focusing on cross-border communication issues. It

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(1) Wells, S (2002), 'UK interbank exposures: systemic risk implications', Bank of England *Financial Stability Review*, December, pages 175–82. See also Elsinger, H, Lehar, A, and Summer, M (2006), 'Using market information for banking system risk assessment', *International Journal of Central Banking*, Vol. 2, No. 1, pages 137–65.

(2) See the Memorandum of Understanding between HM Treasury, the Bank of England and the Financial Services Authority, March 2006. Available at [www.bankofengland.co.uk/financialstability/mou.pdf](http://www.bankofengland.co.uk/financialstability/mou.pdf). More detail on the crisis management framework may be found at [www.bankofengland.co.uk/publications/other/financialstability/briefing\\_051209.pdf](http://www.bankofengland.co.uk/publications/other/financialstability/briefing_051209.pdf).

(3) See [www.ecb.int/press/pr/date/2005/html/pr050518\\_1.en.html](http://www.ecb.int/press/pr/date/2005/html/pr050518_1.en.html).

## Box 8 Risk assessment and crisis management

No two financial crises are the same. As a result, the preparations which central banks and other authorities make for managing a crisis — co-ordinated in the United Kingdom by the Tripartite Standing Committee comprising the Bank, the Financial Services Authority and HM Treasury — need to be flexible.

These preparations are underpinned by regular assessments of vulnerabilities in the UK financial system. These inform work on the UK and international crisis management frameworks and on *ex-ante* information gathering. They also develop a reserve of analysis and expertise which can be drawn on during an actual crisis.

Some crises are triggered by a steady accumulation of small shocks rather than some sudden event. For example, in Japan a macroeconomic downturn in the early 1990s combined with equity and property price falls to erode gradually corporate creditworthiness and collateral values. However, partly because banks did not report non-performing loans or provisions against losses until borrowers were close to default, the impact on capital ratios and the financial system emerged only with a lag. Although some small institutions failed earlier, the major banks did not experience serious difficulties until 1997.

The gathering of market intelligence and risk assessment may allow such vulnerabilities to be detected at an early stage. This can give time to help prevent a crisis. Even if a crisis cannot be averted, early detection may give extra time to prepare contingency plans and focus attention on likely stress points.

As discussed in Section 3, idiosyncratic or financial sector events may evolve more rapidly. The LTCM crisis described in Box 7 is one example. Fraud — as, for instance, in the case of Barings — or other concealed problems are also inherently unpredictable. Past

experience suggests that wholesale funding — on which UK banks increasingly rely — can be withdrawn quickly and unpredictably, as in the case of the 1984 run on Continental Illinois Bank, which was almost entirely wholesale funded. Continental's vulnerability built up gradually. After loan quality problems emerged in 1982, the bank's access to domestic money markets became limited, forcing it to rely on foreign funding. In May 1984, rumours that Continental faced bankruptcy prompted the rapid withdrawal of much of this — as well as remaining domestic interbank deposits — in the ten days before the US authorities announced a blanket guarantee of the bank's deposits.

To cope with such 'fast-burn' crises, the authorities need to be prepared to take effective decisions quickly. The initiatives described in this section to produce MoUs between the UK and EU authorities, and to create 'Factbooks' on financial firms, are designed to support this.

Official intervention to mitigate a crisis carries risks — both financial risks and the risk that private sector incentives to avoid future crises will be reduced. The understanding and experience developed through risk assessment work can help the authorities to judge whether the gravity of the crisis justifies those risks. *Ex-ante* identification of vulnerabilities also helps target the authorities' efforts to enhance their 'toolkit' of possible responses to crises. For example, one benefit of the reforms to the sterling money markets described in this section is that they have given many more UK banks direct access to central bank liquidity. Regular monitoring of potential shocks and vulnerabilities also helps to design realistic tests of the procedures which would be followed in a crisis, such as the planned test of responses to a pandemic flu outbreak.

Crises that slip under the risk assessment 'radar' can never be ruled out. But having that 'radar' function, and the expertise to maintain it, can make those responses better informed and so more effective.

remains important to continue to develop practical arrangements to aid international co-ordination — for example, by identifying in advance the information that authorities could and should provide to each other in a crisis and by discussing in advance of any event the issues which complicate the resolution of crises spanning different jurisdictions.

*...include improved information availability.*

Past UK financial crisis management exercises have underscored the importance of up-to-date information in guiding crisis responses. The FSA is leading a project — the ‘Factbooks initiative’ — to establish core information relevant to such responses for around 60 financial firms in the United Kingdom.<sup>(1)</sup> This includes proposals to draw together systematically important information already available to the authorities and also for the FSA to collect additional information from a subset of these firms both periodically and specifically during any crisis. The Factbooks will enable data on firms to be routinely shared between the UK authorities in a readily accessible way. Looking ahead, it will be important that these new processes involving the private sector are tested — for example, to confirm that data can indeed be transmitted to the authorities in a way that meets crisis management needs. An important component of Factbooks is firms’ contingency funding plans. Further work on the implications of a number of firms simultaneously invoking their plans, and on the assumptions underlying them, may be useful in identifying and reducing obstacles to effective liquidity management in a crisis. It may also inform more efficient responses by the authorities.

*The UK authorities have assessed the resilience of the UK financial sector...*

During 2005, the UK authorities conducted a survey of over 60 major UK-operating financial institutions and infrastructures to assess their contingency plans in the event of operational disruption.<sup>(2)</sup> The survey was intended to help benchmark resilience across the financial sector, including potential dependencies between firms, and thereby serve as a guide to contingency planning by individual firms and by the authorities. The UK authorities also conducted a market-wide test of business continuity arrangements in November 2005, involving some 70 financial institutions and infrastructures.<sup>(3)</sup>

The conclusions from these exercises were broadly positive. Systems and supporting infrastructures surveyed were generally found to be robust. For those surveyed, the majority of business volumes were found to be recoverable within four hours of recovery plans being invoked following a major operational disruption (Table 4.C), although the full effects of

**Table 4.C** Findings of the Resilience Benchmarking Project:<sup>(a)</sup> recovery rates for critical business functions<sup>(b)</sup>

	Recovery period <sup>(c)</sup> (hours)	Normal daily values (percentage of)	Normal daily volumes (percentage of)
Wholesale payments	Within 2	55 to 85	50 to 70
	Within 4	70 to 90	55 to 75
	Within 24	75 to 95	70 to 90
Trade clearing	Within 2	20 to 40	15 to 35
	Within 4	55 to 75	55 to 75
	Within 24	75 to 95	75 to 95
Settlement	Within 2	30 to 50	20 to 40
	Within 4	45 to 65	40 to 60
	Within 24	65 to 85	60 to 80

Source: FSA, *Resilience Benchmarking Project Discussion Paper*, December 2005.

(a) Available at [www.fsc.gov.uk/upload/public/Files/9/Web%20-%20Res%20Bench%20Report%2020051214.pdf](http://www.fsc.gov.uk/upload/public/Files/9/Web%20-%20Res%20Bench%20Report%2020051214.pdf).

(b) Responses to the question: ‘What percentage of normal values/volumes would be restored within x hours of the decision to invoke your recovery plan?’.

(c) Period after recovery plan invoked.

(1) See [www.fsa.gov.uk/pubs/other/factbooks\\_feedback.pdf](http://www.fsa.gov.uk/pubs/other/factbooks_feedback.pdf).

(2) See [www.fsa.gov.uk/pages/Library/Communication/PR/2005/136.shtml](http://www.fsa.gov.uk/pages/Library/Communication/PR/2005/136.shtml).

(3) See [www.fsa.gov.uk/pages/About/Teams/Stability/exercise\\_2005.shtml](http://www.fsa.gov.uk/pages/About/Teams/Stability/exercise_2005.shtml).

a widespread and catastrophic event could result in markets being affected for a longer period of time. The main lessons related to staff planning; the need for improved co-ordination between institutions in the face of system-wide stresses, including through joint tests; and the need for the key UK infrastructures (including CREST, CHAPS, LCH.Clearnet Ltd and SWIFT) to give clearer indications to the market of their recovery expectations. Co-ordination has been improved with the establishment of the Cross-Market Business Continuity Group, which would feed information from private sector firms to the authorities in a crisis and facilitate private sector decisions and workarounds to alleviate pressures on the system. Based on these findings, the UK authorities are producing a sound practices guide on business continuity for the financial sector later this year. A shorter version of the benchmarking survey is also planned later in the year for smaller and less complex firms in the UK financial sector.

*...including to a flu pandemic outbreak...*

The FSA has also recently carried out a survey of some 30 major firms' readiness to deal with a flu pandemic. This found that many major firms had done some preparatory work following World Health Organization and UK Department of Health guidelines, centred on risk assessment and the identification of critical functions. The testing of the UK financial sector's response to a potential flu pandemic is clearly important and a tripartite market-wide test is planned for later this year to examine the reactions of both the private and official sector to such an event.

*...with the Bank focusing on the core payment infrastructures.*

The Bank has particular responsibilities for overseeing the United Kingdom's systemically important payment systems, including ensuring these systems are robust to operational and other risks. The Bank's most recent risk assessment of these systems is contained in the *Payment Systems Oversight Report 2005*.<sup>(1)</sup>

In general, the Bank believes the core UK payment infrastructures — and participants in those systems — are robust and have contingency plans in place that broadly reflect good market practice to deal with operational problems (Table 4.D). Where these plans tend to be less robust, however, is in capturing responses to operational problems affecting the financial system as a whole. As discussed in Section 3, given the dependency of many UK institutions and infrastructures on SWIFT, such contingency plans should extend to messaging services.

Effective plans to mitigate the impact of such system-wide events would need the following ingredients. First, a clear

**Table 4.D** Summary assessment of the main wholesale UK payment systems against Core Principles<sup>(a)</sup>

	CHAPS £ and €	CREST £ and €	CREST US\$	LCH.Clearnet Ltd PPS <sup>(b)</sup>
I: Legal basis	Partly observed	Observed	Partly observed	Observed
II: Understanding financial risks	Partly observed	Observed	Partly observed	Observed
III: Management of financial risks	Partly observed	Observed	Partly observed	Observed
IV: Prompt final settlement	Partly observed	Observed	Partly observed	Observed
V: Settlement in multilateral netting systems	Not applicable	Not applicable	Not applicable	Not applicable
VI: Settlement asset	Partly observed	Observed	Partly observed	Observed
VII: Security and operational reliability	Partly observed	Observed	Partly observed	Observed
VIII: Efficiency	Partly observed	Observed	Partly observed	Observed
IX: Access criteria	Partly observed	Observed	Partly observed	Observed
X: Governance	Partly observed	Observed	Partly observed	Observed

Source: *Payment Systems Oversight Report 2005*, Bank of England.

(a) The Core Principles for Systemically Important Payment Systems, designed by the Committee on Payment and Settlement Systems, provide a set of minimum standards for risk management in systemically important payment systems. See [www.bis.org/publ/cpps43.pdf](http://www.bis.org/publ/cpps43.pdf) for a description of the Core Principles.  
 (b) The LCH.Clearnet Ltd Protected Payments System (PPS) enables settlement of obligations between LCH.Clearnet Ltd and its members in twelve currencies. The assessment shown above relates to the main three currencies settled, namely sterling, euro and US dollar. One exception to the assessment shown above is that the Bank continues to assess the UK PPS's arrangements for US dollar settlement partly to observe Core Principle VI, and for the US PPS's arrangements for US dollar settlement broadly to observe Core Principle VI (see Annex C, *Payment Systems Oversight Report 2005*).

(1) Available at [www.bankofengland.co.uk/publications/psor/index.htm](http://www.bankofengland.co.uk/publications/psor/index.htm).

understanding among market participants of infrastructures' contingency plans and the business implications of those plans. Second, an understanding of what actions the public authorities might take, domestically and on a co-ordinated international basis, in response to an infrastructure problem. And third, plans within the private sector that are mutually compatible and tested.

While there has been some progress over the past six months, further work is needed, in particular on the second and third elements. On the first, many market infrastructures already provide some level of business continuity guidance to users; for example, SWIFT recently issued an update to its user handbook to add more detail on its contingency plans. Nonetheless, further work remains to be done in this area to ensure users have thought through the implications of this guidance. On the second, recent reforms to the sterling money markets would help in managing the liquidity consequences of an infrastructure problem in the United Kingdom. Internationally, however, there is a need for further work on co-ordination and information sharing between the authorities. Finally, it is in the area of private sector co-ordination that the need for greater planning and testing is greatest for system-wide disruptions, such as those associated with a disruption to market infrastructures or messaging services. The UK authorities have recently tested their own responses to such an event.

The Bank aims to help facilitate these mitigating actions and to help test them once in place. Longer term, there may be a case for UK financial firms and infrastructures to consider enhancing their backup arrangements with alternative standby suppliers of communication services, to reduce the risk of a single point of failure.

## Other financial stability publications

This section provides a short summary of other financial stability related publications released by the Bank of England since the December 2005 FSR.

### Regular publications

#### *The Payment Systems Oversight Report 2005.*

The *Payment Systems Oversight Report* provides an account of how the Bank is discharging its responsibility for oversight of UK payment systems. The latest *Report* is available on the Bank's website at:

[www.bankofengland.co.uk/publications/psor/index.htm](http://www.bankofengland.co.uk/publications/psor/index.htm).

#### *Markets and operations article, Bank of England Quarterly Bulletin, Summer 2006.*

This article reviews developments since the Spring *Quarterly Bulletin* in sterling and global financial markets, in market structure and in the Bank's balance sheet. The latest *Quarterly Bulletin* is available on the Bank's website at:

[www.bankofengland.co.uk/publications/quarterlybulletin/qb0602.pdf](http://www.bankofengland.co.uk/publications/quarterlybulletin/qb0602.pdf).

### Speeches

#### *Remarks at a Chatham House Conference on Global Financial Imbalances.*

Rachel Lomax, Deputy Governor, January 2006.

[www.bankofengland.co.uk/publications/speeches/2006/speech265.pdf](http://www.bankofengland.co.uk/publications/speeches/2006/speech265.pdf)

This speech discusses whether the current pattern of financial imbalances between major economies presents a threat to economic activity and financial stability, and whether the current international monetary system has sufficient incentives to ensure an orderly unwinding of these imbalances. The speech discusses different interpretations of global imbalances and identifies key features of the international monetary system that are particularly relevant for financing, containing and correcting imbalances. Rachel Lomax argues that an open-ended commitment by Asian central banks to finance ever increasing US deficits is implausible going forward. In light of this, the speech argues that there is no case for reintroducing Bretton Woods type constraints but instead policymakers need to manage risks within the current system. Policymakers must ensure excellent policy communication, to reduce uncertainty and limit the risk of sharp market corrections, and they also need to appreciate better the interdependencies between policy decisions in different countries.

#### *Reform of the International Monetary Fund.*

Mervyn King, Governor, February 2006.

[www.bankofengland.co.uk/publications/speeches/2006/speech267.pdf](http://www.bankofengland.co.uk/publications/speeches/2006/speech267.pdf)

In this speech, the Governor notes the vast changes that have taken place in the international financial system since the establishment of the Bretton Woods institutions. In particular, the dramatic growth in private capital flows has increased interconnections between national balance sheets and, as a result, the extent to which policies in some countries can spillover to others. The Governor argues that in response the IMF should look to focus its work on the international monetary system around three main tasks: to provide and share information about the balance sheets of all major countries and the links between them; to encourage countries to abide by their commitments to each other by promoting greater transparency about national policies; and to provide a forum for national authorities to discuss risks to the world economy. In pursuing these objectives, the Governor suggests that some reform of the Fund is required, including reducing the size of meetings to encourage the necessary degree of frankness to tackle challenges facing the international financial system.

#### *Uncertainty, the implementation of monetary policy, and the management of risk.*

Paul Tucker, Executive Director for Markets, May 2006.

[www.bankofengland.co.uk/publications/speeches/2006/speech273.pdf](http://www.bankofengland.co.uk/publications/speeches/2006/speech273.pdf)

Paul Tucker discusses the sources of volatility and uncertainty facing firms and financial markets. In particular, the management of risks from pension fund asset-liability mismatches has been an important influence on financial markets in recent years. More generally, the compression in credit spreads and other market-based indicators of risk suggest a fall in the price of risk. It remains unclear to what extent that has reflected structural change or other factors, such as the search for yield. And even where structural change has been the driver, market participants should be careful about extrapolating forward the high returns that might be associated with a period of transition. One key area of structural change within financial markets has been innovation in structured finance, which by distributing risk should buttress financial stability as a whole. However, uncertainties about the liquidity of and demand for structured products under stressed conditions also has the potential to complicate the assessment and pricing of risk across financial markets.

## Financial stability papers

### Costs of sovereign default.

Bianca de Paoli, Glenn Hoggarth and Victoria Saporta, July 2006.

[www.bankofengland.co.uk/publications/fsr/fs\\_paper01.pdf](http://www.bankofengland.co.uk/publications/fsr/fs_paper01.pdf)

This paper assesses the type and size of costs that are associated with sovereign default. In particular, it emphasises that output losses are particularly large when sovereign default is combined with widespread failure of the domestic banking system and/or a currency crisis. Once in a debt crisis, annual output losses seem to increase the longer that countries stay in arrears or take to restructure their debts. There is also evidence that output losses are smaller for countries that restructure their debt than for those that do not. The paper concludes with a number of policy suggestions to improve debt crisis prevention and management and the role played of the IMF.

## Working papers

### Modelling the cross-border use of collateral in payment systems.

Mark J Manning and Matthew Willison, January 2006.

[www.bankofengland.co.uk/publications/workingpapers/wp286.pdf](http://www.bankofengland.co.uk/publications/workingpapers/wp286.pdf)

Over the past decade there has been a marked shift towards real-time gross settlement of high-value payments in central bank money. That has markedly reduced credit risk in the financial system, but has focused the attention of policymakers on the associated liquidity risks. This paper looks at how a bank operating in multiple systems might face a mismatch between the location of the collateral holdings required to back payments and its liquidity needs. The paper uses a stylised model to demonstrate that the associated liquidity risks may be mitigated by allowing cross-border use of collateral. However, in some circumstances, the associated incentives to reduce total holdings of collateral could potentially increase liquidity risk.

### Defined benefit company pensions and corporate valuations: simulation and empirical evidence from the United Kingdom.

Kamakshya Trivedi and Garry Young, March 2006.

[www.bankofengland.co.uk/publications/workingpapers/wp289.pdf](http://www.bankofengland.co.uk/publications/workingpapers/wp289.pdf)

The majority of full-time employees in the United Kingdom are members of funded, company-sponsored pension schemes.

And most pension entitlements in these schemes remain defined benefit in nature. The shareholders of sponsoring companies are primarily responsible for ensuring pension-scheme solvency, and in the United Kingdom most defined-benefit pension schemes are largely invested in equities. This provides scope for pension schemes to amplify shocks to companies' stock market valuations. The paper uses a stylised model of a company's market value to show how shocks can be amplified through the additional leverage induced by pension liabilities and pension fund cross-holdings of equities. Econometric analysis of equity price volatility for a sample of UK companies confirms that these effects are significant.

### Switching costs in the market for personal current accounts: some evidence for the United Kingdom.

Céline Gondat-Larralde and Erlend Nier, March 2006.

[www.bankofengland.co.uk/publications/workingpapers/wp292.pdf](http://www.bankofengland.co.uk/publications/workingpapers/wp292.pdf)

This paper provides an analysis of the competitive process in the market for personal current accounts in the United Kingdom over the period 1996–2001. It finds only a gradual change in the distribution of market shares over this period, in contrast with a marked dispersion in the rates offered on retail deposits which appears to be persistent over time. The analysis suggests that customer switching costs are likely to be a key factor behind the low price elasticity of current account market shares over this period. These results are therefore broadly supportive of recent initiatives to facilitate switching between bank accounts in the United Kingdom.

### Resolving banking crises — an analysis of policy options.

Misa Tanaka and Glenn Hoggarth, March 2006.

[www.bankofengland.co.uk/publications/workingpapers/wp293.pdf](http://www.bankofengland.co.uk/publications/workingpapers/wp293.pdf)

This paper looks at policy options open to the authorities and provides practical guidance to policymakers in resolving bank failures. It shows that, without regulatory intervention, weak banks have incentives to hold on to their non-performing loans and gamble on the recovery of these loans. Consequently, if the authorities cannot observe banks' balance sheets, they may have to rely on financial incentives to induce failing banks to liquidate bad debts. If the failing banks can be closed without causing a systemic crisis, the 'first-best' policy is one where the authorities close all banks that are unable to raise a minimum level of new capital. If closing the failing banks could cause a systemic crisis, the second-best solution is for the authorities to inject equity into the banks. If that option is not used, it would be less costly to subsidise the liquidation of non-performing loans than to inject subordinated debt.

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## Glossary and other information

### Glossary of selected data and instruments

**ABS** – asset-backed security.  
**CD** – certificate of deposit.  
**CDO** – collateralised debt obligation.  
**CDS** – credit default swap.  
**CPI** – consumer prices index.  
**CPPI** – constant proportion portfolio insurance.  
**CRD** – Cash Ratio Deposit.  
**Euribor** – euro interbank offered rate.  
**FIN** – one of SWIFT's core messaging services.  
**GDP** – gross domestic product.  
**Libor** – London interbank offered rate.  
**MBS** – mortgage-backed security.  
**RPI** – retail prices index.

### Abbreviations

**BIS** – Bank for International Settlements.  
**CBI** – Confederation of British Industry.  
**CHAPS** – Clearing House Automated Payment System.  
**CLS** – Continuous Linked Settlement.  
**CME** – Chicago Mercantile Exchange.  
**CRMPG** – Counterparty Risk Management Policy Group.  
**CPSS** – Committee on Payment and Settlement Systems.  
**DTI** – Department of Trade and Industry.  
**EME** – emerging market economy.  
**EU** – European Union.  
**FSA** – Financial Services Authority.  
**FSR** – Financial Stability Review/Report.  
**FTSE** – Financial Times Stock Exchange.  
**G3** – the euro area, Japan and the United States.  
**G7** – Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.  
**G10** – Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.  
**GM** – General Motors.  
**HMT** – Her Majesty's Treasury.  
**IFRS** – International Financial Reporting Standards.

**IMF** – International Monetary Fund.  
**IMFC** – International Monetary and Financial Committee.  
**IRB approach** – internal ratings-based approach.  
**ISDA** – International Swaps and Derivatives Association, Inc.  
**LBO** – leveraged buyout.  
**LCFI** – large complex financial institution.  
**LTCM** – Long-Term Capital Management.  
**LTV** – loan to value.  
**MBO** – management buyout.  
**MoU** – Memorandum of Understanding.  
**MPC** – Monetary Policy Committee.  
**MSCI** – Morgan Stanley Capital International Inc.  
**OMO** – open market operations.  
**ONS** – Office for National Statistics.  
**OTC** – over the counter.  
**P&L** – profit and loss.  
**PNFC** – private non-financial corporations.  
**PPS** – Protected Payments System.  
**S&P** – Standard and Poor's.  
**SEC** – US Securities and Exchange Commission.  
**SWIFT** – Society for Worldwide Interbank Financial Telecommunication.  
**VaR** – Value-at-Risk.



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