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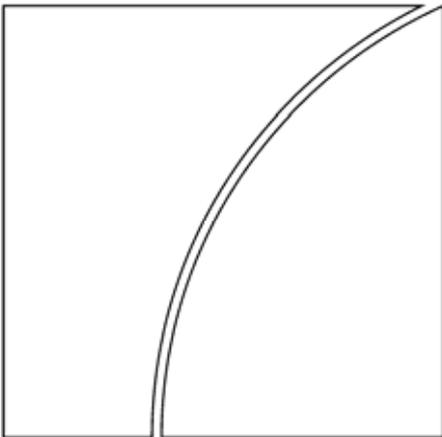
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### The financial turmoil of 2007–?: a preliminary assessment and some policy considerations

by Claudio Borio

Monetary and Economic Department

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## Abstract

The unfolding financial turmoil in mature economies has prompted the official and private sectors to reconsider policies, business models and risk management practices. Regardless of its future evolution, it already threatens to become one of the defining economic moments of the 21st century. This essay seeks to provide a preliminary assessment of the events and to draw some lessons for policies designed to strengthen the financial system on a long-term basis. It argues that the turmoil is best seen as a natural result of a prolonged period of generalised and aggressive risk-taking, which happened to have the subprime market at its epicentre. In other words, it represents the archetypal example of financial instability with potentially serious macroeconomic consequences that follows the build-up of financial imbalances in good times. The significant idiosyncratic elements, including the threat of an unprecedented involuntary “reintermediation” wave for banks and the dislocations associated with new credit risk transfer instruments, are arguably symptoms of more fundamental common causes. The policy response, while naturally taking into account the idiosyncratic weaknesses brought to light by the turmoil, should be firmly anchored to the more enduring factors that drive financial instability. This essay highlights possible mutually reinforcing steps in three areas: accounting, disclosure and risk management; the architecture of prudential regulation; and monetary policy.

JEL classification: E44, G10, G20, G28, E30, E50.

Keywords: Financial turmoil, risk, liquidity, prudential regulation, accounting, ratings, monetary policy.



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## Introduction<sup>1</sup>

On 9 August 2007 the interbank markets of the United States and the euro area came under unexpected and severe strains. This prompted an immediate and determined response by the respective central banks aimed at restoring more orderly conditions through large gross injections of liquidity. Similar strains emerged in other developed economy interbank markets, not least those of the United Kingdom, Switzerland, Canada, Australia and, to a lesser extent, Japan. What until then might have appeared as yet another well absorbed temporary upward adjustment in the pricing of risk, like those already seen in 2005 and 2006, but this time with the US subprime segment as the focal point, had turned out to herald much more serious dislocations at the very heart of the global financial system. With a bang, the current financial turmoil had announced its arrival.

Half a year later, at the time of writing (February), there are no signs that the turmoil is abating. To be sure, tensions in the interbank market have eased since their peak at year-end, when they were exacerbated by seasonal demands for liquidity. But writedowns by financial institutions have continued, worrisome strains have spread to monoline insurers, and the prospects are for a further deterioration in asset quality as property prices continue to soften, credit terms are tightened and the global economy weakens. In short, the credit cycle has begun to turn. And what had started as a liquidity crunch has gradually been revealing itself as a deeper asset quality problem.

It is too early to tell how the future will unfold. But, regardless of whether the prevailing tensions in the global financial system are characterised as “turmoil” or “crisis”, they have already been sufficient to induce the international community to assign policy priority to them. It is therefore useful to attempt a preliminary assessment of the events, seeking to draw possible implications for the design of policy.

In assessing the events and devising a policy response, it is important not to be blinded by their idiosyncratic features. All instances of financial distress have evident episode-specific elements, often linked to the type of financial innovation that precedes them. And yet, what is common to the episodes is more important, as it hints at the more enduring factors underlying the dynamics of financial instability. A policy response has a greater chance of being effective and long-lasting if it is firmly anchored on those common elements, although it obviously also needs to take into account the idiosyncratic ones (Borio (2007a)).

The argument developed in this paper is that the unfolding turmoil is best seen as a natural result of a prolonged period of generalised and aggressive risk-taking, which happened to have the subprime market at its epicentre. In other words, it represents the archetypal example of financial instability with potentially serious macroeconomic consequences that follows the build-up of financial imbalances in good times, in the form of overstretched balance sheets, masked by the veneer of buoyant asset prices and strong economic growth. Idiosyncratic elements have no doubt been present, including the threat of an unprecedented involuntary “reintermediation” wave for banks and the dislocations associated with new credit risk transfer instruments. But these elements represent only the more superficial aspects of the story. In many respects, they are symptoms of more fundamental common causes.

The rest of this paper is structured as followed. The first section outlines the stylised facts of the financial turmoil. The second offers a preliminary interpretation, trying to distinguish the idiosyncratic from the more systematic elements. The third explores the contours of a

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<sup>1</sup> This paper was prepared for a special issue of the Bank of Spain's *Financial Stability Report*. It incorporates information *only up to the end of February 2008*. I would like to thank Philippe Hainaut for excellent statistical assistance and Richard Cantor, Ingo Fender, Francois-Louis Michaud, Frank Packer, Nikola Tarashev, Kostas Tsatsaronis, Stefan Walter and Haibin Zhu for their very helpful comments. The views expressed are my own and do not necessarily reflect those of the Bank for International Settlements.

possible policy response; the focus here is not on responses to address the unfolding turmoil per se, but on those that could strengthen the financial system on a more structural basis. The final section concludes.

## 1. The financial turmoil: stylised facts

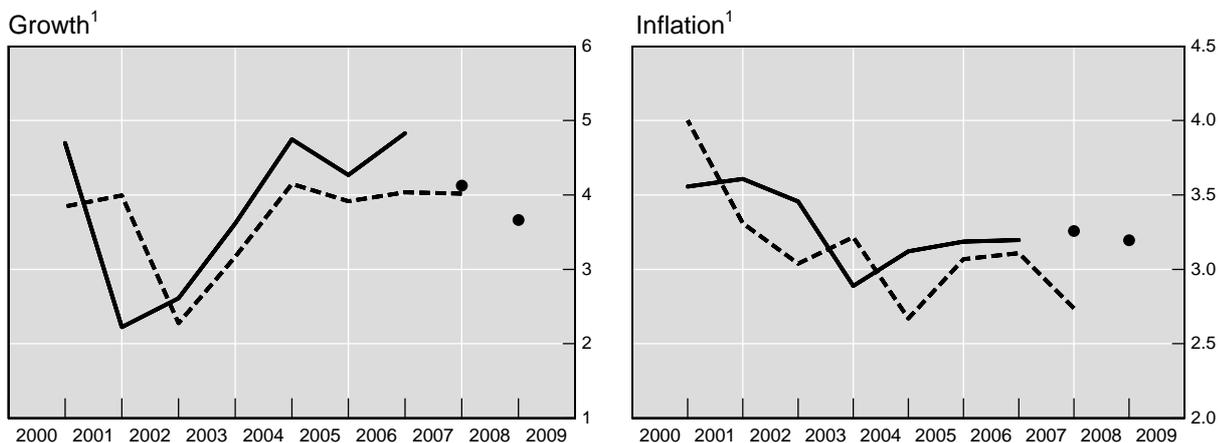
### Prologue

The years that preceded the recent turbulence saw an exceptionally strong performance of the world economy – another phase of what has come to be known as the “Great Moderation”. Following the global slowdown of 2001, the world economy had recovered rather rapidly, posting record growth rates in 2004, 2005 and 2006. Remarkably, while some potential inflationary pressures could be seen towards the end of the period on the back of rapid increases in commodity prices, inflation had remained extraordinarily quiescent (BIS (2007a)).<sup>2</sup> Based on consensus forecasts, as recently as in June 2007 the future looked as bright as the past (Graph 1): both private and official forecasts foresaw a welcome mild reduction in growth rates, closer to estimates of potential growth, with little change in inflation.

This strength went hand in hand with unusually strong performance in financial markets and the financial system more generally, underpinned by the strength of asset prices (Graph 2). Pretty much globally, residential property prices had been rising rapidly, acting as a critical support for household spending. Their prolonged strength had been especially in evidence in several English-speaking countries, including the United States, in some European economies, including Spain, and in parts of Asia, not least China. Across a wide spectrum of asset classes, volatilities and risk premia looked exceptionally low, including to varying degrees in fixed income, credit, equity and foreign exchange markets. The recorded

Graph 1

### Remarkable macroeconomic performance



<sup>1</sup> In per cent. The dashed lines show the consensus forecasts made at the end of the preceding year; the dots show forecasts for 2007 and 2008 as of December 2007. Annual changes in real GDP and consumer prices. Average of countries available in Consensus Economics.

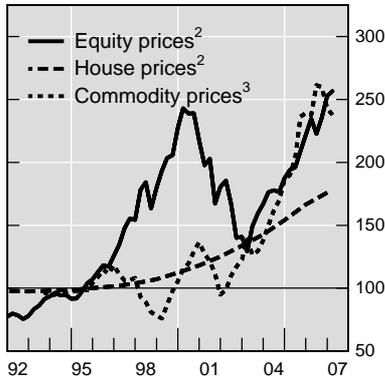
Sources: © Consensus Economics; national data; BIS calculations.

<sup>2</sup> The references in this paper are mainly to BIS work. For a more comprehensive bibliography, the reader is referred to the original pieces of research mentioned here.

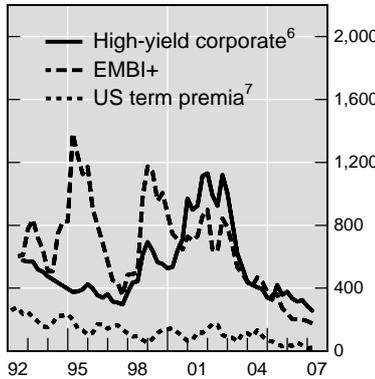
Graph 2

**Buoyant asset markets**

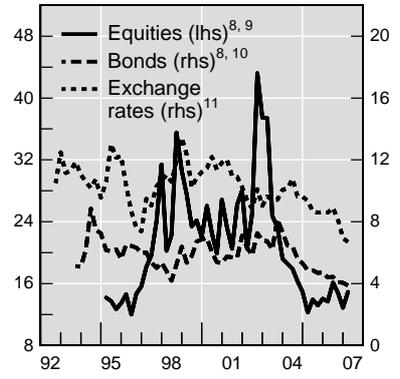
Asset and commodity prices<sup>1</sup>



Bond spreads<sup>4, 5</sup>



Implied volatilities<sup>4</sup>



<sup>1</sup> 1995 = 100. <sup>2</sup> Sixteen OECD countries; weighted averages based on 2000 GDP and PPP exchange rates. <sup>3</sup> Goldman Sachs Commodity index, in US dollar terms, deflated by US CPI; quarterly averages. <sup>4</sup> Quarterly averages. <sup>5</sup> In basis points. <sup>6</sup> As from December 1997, simple average of United States and euro area high-yield indices, otherwise only US. <sup>7</sup> Estimated for 10-year zero coupon Treasuries. <sup>8</sup> Simple average of the United States and Germany. <sup>9</sup> Derived from the price of call option contracts on stock market indices. <sup>10</sup> Price volatility implied by the price of call options on 10-year government bond future contracts. <sup>11</sup> JPMorgan benchmark index for the level of G7 currencies' implied volatility.

Sources: OECD; Bloomberg; Datastream; Merrill Lynch; JPMorgan Chase; national data

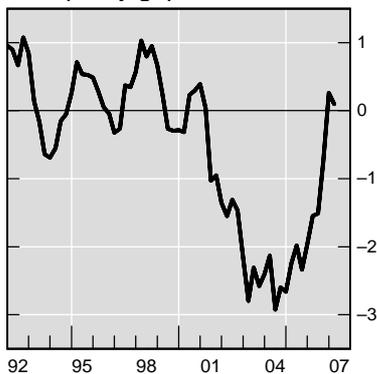
profitability and capital position of financial intermediaries was high by historical standards.

Against the backdrop of historically low interest rates and booming asset prices, credit aggregates, alongside monetary aggregates, had been expanding rapidly (Graph 3). Despite the rapid increase in credit, however, the balance sheets and repayment capacity of corporations and, to a lesser extent, households did not appear to be under any strain. The high level of asset prices kept leverage ratios in check while the combination of strong income flows and low interest rates did the same with debt service ratios. In fact, in the

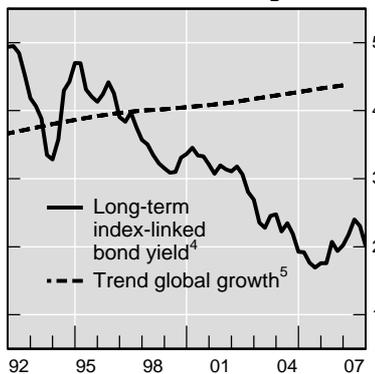
Graph 3

**Low interest rates and ample global liquidity**

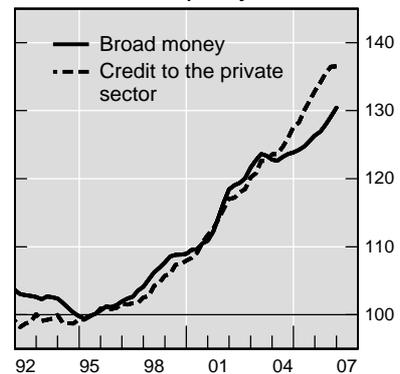
Real policy gap<sup>1, 2</sup>



Interest rate and trend growth<sup>3</sup>



Measures of liquidity<sup>1, 6</sup>



<sup>1</sup> Sixteen OECD countries; weighted averages based on 2000 GDP and PPP exchange rates. <sup>2</sup> Real policy rate minus natural rate. The real rate is the nominal rate adjusted for four-quarter consumer price inflation. The natural rate is defined as the average real rate 1985–2000 (for Japan, 1985–95; for Switzerland 2000–05) plus the four-quarter growth in potential output less its long-term average. <sup>3</sup> In per cent. <sup>4</sup> From 1998; simple average of Australia, France, the United Kingdom and the United States; otherwise only Australia and the United Kingdom. <sup>5</sup> Trend world real GDP growth as estimated by the IMF. <sup>6</sup> Relative to nominal GDP; 1995 = 100.

Sources: IMF; OECD; Bloomberg; national data; BIS calculations and estimates.

aggregate, the corporate sector enjoyed unusually strong profitability and a comfortable liquidity position, even though in some sectors leverage was elevated as a result of very strong leveraged buyout (LBO) and so-called “recapitalisation” activity. Only debt-to-income ratios, at least those of the household sectors, exhibited a marked upward trend, on the back of a major rise in mortgage debt (CGFS (2006)).

This long expansionary phase in the global economy had been punctuated by isolated jitters in financial markets. With a certain regularity, markets suffered from bouts of spikes in risk aversion and uncertainty, triggering a repricing of risk. The specific causes and manifestations varied. In May 2005, for instance, the epicentre of the dislocations had been the CDS market for corporate credits, owing to the unexpected downgrade of a large manufacturing firm in the United States. In the early months of 2006, following rising concerns about higher inflation, the dislocations had affected primarily emerging market asset classes. In each case, however, markets had rebounded strongly, exhibiting considerable resilience.

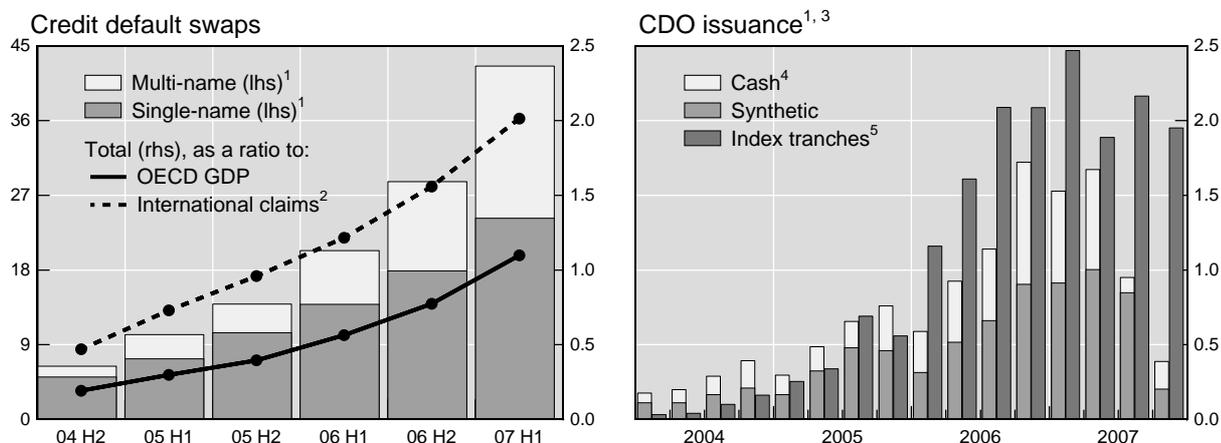
At a structural level in the financial system, recent years had seen an acceleration of financial innovation. The main manifestation had been the extraordinary expansion of credit risk transfer instruments, which permitted the transfer, hedging and active trading of credit risk as a separate asset class (Graph 4). Examples included credit default swaps (CDSs) and, in particular, structured credit products, through which portfolios of credit exposures could be sliced and diced and repackaged to better suit the needs of individual investors. This category included, in particular, collateralised debt obligations (CDOs), backed both by cash instruments, such as primitive securities, loans or asset-backed securities, and by derivative claims, such as CDSs and CDOs themselves (Graph 4). The expansion of these products had both contributed to, and been supported by, a strengthening of the originate-and-distribute (O&D) business model of financial intermediation. Increasingly, rather than holding the credits they originated, credit institutions would sell them off, possibly after having repackaged them, into the capital markets.

### The unfolding play

It was against this backdrop that the current financial turmoil took shape. The unfolding

Graph 4

### Spectacular growth of credit risk transfer instruments



<sup>1</sup> In trillions of US dollar. <sup>2</sup> Of BIS reporting banks; cross-border and local foreign currency claims. <sup>3</sup> Annualised. <sup>4</sup> Sum of cash tranche sizes by pricing date; includes only cash and hybrid structures. Hybrid portfolios consisting mainly of structured finance products different from cash CDOs are excluded. <sup>5</sup> Covers about 80% of index trade volume, according to CreditFlux Data+.

Sources: IMF; CreditFlux Data+; ISDA; national data; BIS calculations.

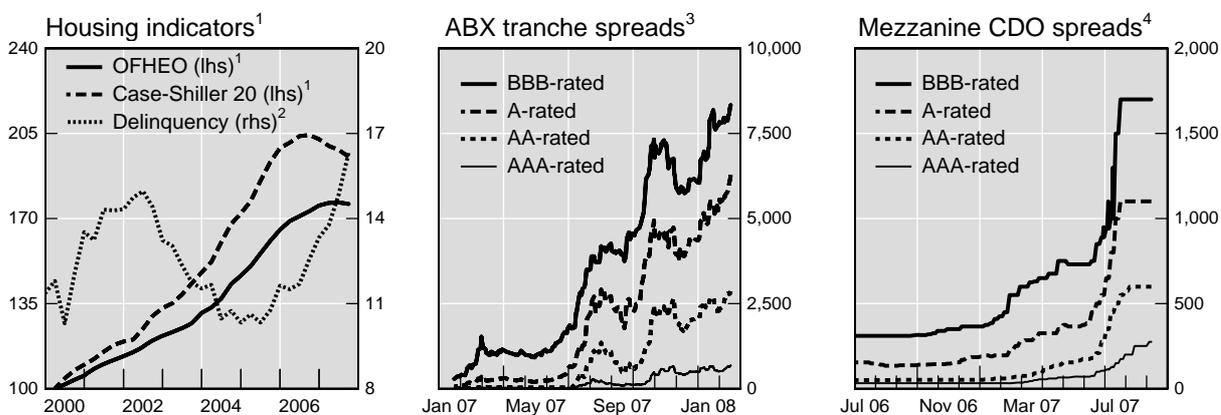
turmoil has proceeded in a number of phases: an initial seemingly orderly repricing of credit risk in the US subprime market; a much sharper adjustment following news of losses at troubled hedge funds, downgrades of structured products and strains in the LBO market; a market and funding liquidity squeeze on investment vehicles; serious tensions in the interbank market and strains at some credit institutions; and broader concerns about deteriorating asset quality, including among monoline insurers, exacerbated by a darkening outlook for the real economy. Annex 1 provides a chronology of the main events.

The first significant warning signs of a repricing of risk emerged as far back as January 2007 (BIS (2007b) and Graph 5). Delinquencies in the US subprime market had started to increase two years previously and residential property prices to fall in some regions while peaking in late 2006 on a nationwide basis. But it was only in January and February that, after having risen gradually since November, spreads on some structured products with exposures to this market widened substantially, even as corporate credit spreads continued to tighten towards historical lows. The widening was especially pronounced in ABX tranche spreads, an index on home-equity loans, as well as in those of certain mezzanine (BBB) CDO tranches backed by asset-backed securities (ABSs). This increase, itself in part an element in a very brief more general sell-off in markets due to jitters about the economic outlook, was subsequently partly reversed: the uncertainties that had generated it subsided and problems were expected to remain limited and contained in the subprime segment.

Expectations were dashed in mid-June, however, when signs of a more damaging repricing began to multiply. Spreads started to climb much more sharply again following downgrades of ABS mortgage pools and, above all, in response to reports that two Bear Stearns hedge

Graph 5

**US subprime mortgage market comes under stress**



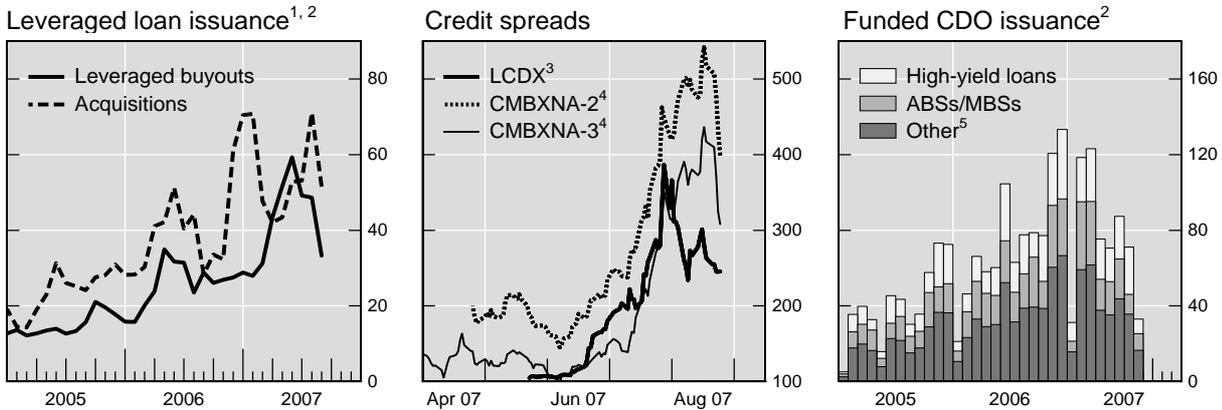
<sup>1</sup> House price indices; Q1 2000 = 100. <sup>2</sup> Subprime loan delinquencies as a percentage of total subprime loans; seasonally adjusted, in per cent. <sup>3</sup> JPMorgan Chase home equity (ABX.HE 2006-2) floating closing on-the-run spreads, in basis points. <sup>4</sup> Spreads over Libor of tranches of CDOs backed by mezzanine tranches of ABSs, in basis points (primary market). The horizontal paths starting in July reflect stale quotes, owing to the drying-up of market liquidity.

Sources: Datastream; JPMorgan Chase; LoanPerformance.

funds might need to be shut down following very heavy losses in a matter of weeks. Particularly disruptive was another round of unexpected downgrades in mid-July, when CDO tranches were put under review, against the backdrop of a further stream of bad news in the US mortgage market. Problems spread to the leveraged loan market, as institutional, including hedge fund, demand for collateralised loan obligations (CLOs) faltered, preventing the market financing of the deals already in the pipeline (Graph 6). Paper backed by commercial real estate collateral also suffered.

Graph 6

**Credit spreads widen sharply and issuance slumps**



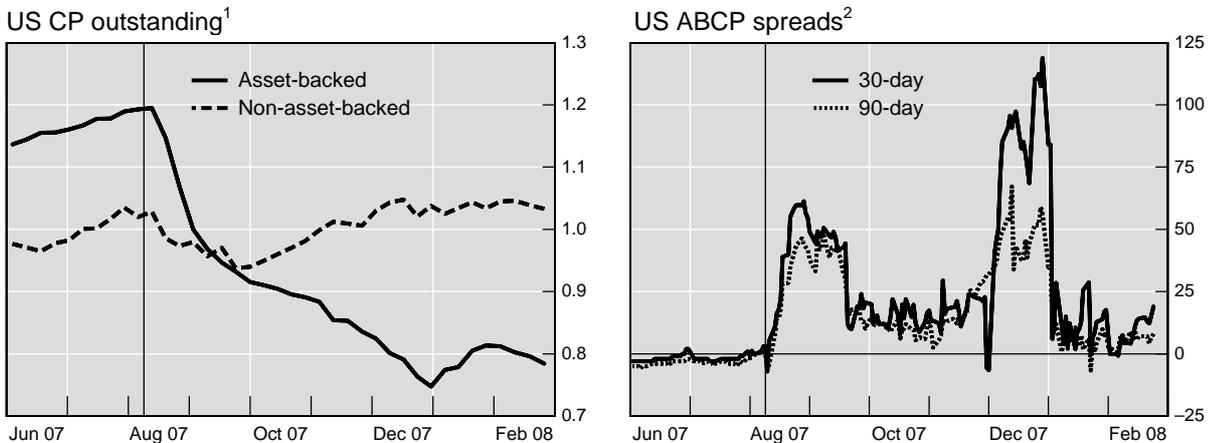
<sup>1</sup> Three-month moving averages, in US dollars. <sup>2</sup> Data for August 2007 are partial. <sup>3</sup> Index spreads for five-year CDSs on syndicated US loans. <sup>4</sup> Index spreads for BBB tranches of commercial mortgage-backed securities (index series 2 and 3). <sup>5</sup> Emerging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

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

The true amplitude of the unfolding turmoil became evident only in late July-early August, when a liquidity crunch began to surface through a series of confidence-shaking news (BIS (2007c) and Graph 7). In late July, still very much below the radar screen, some asset-backed commercial paper (ABCP) programmes started to face roll-over difficulties, as nervous investors began to pull back following concerns about their underlying asset quality, forcing the providers of liquidity backup to step in. On 30 July IKB, a German bank, unable to take over the obligations of its struggling ABCP funding vehicle, had to be supported with a cash injection from its main shareholder bank, KfW, pointing to serious asset quality strains at an institution rated investment grade. In early August, a number of further ABCP programmes exercised for the first time the option to extend maturities. And on 9 August, highlighting the underlying problems, Paribas suspended redemptions on three of its funds,

Graph 7

**The asset-backed commercial paper (ABCP) markets seize up**



The vertical lines indicate 9 August.

<sup>1</sup> In trillions of US dollars. <sup>2</sup> ABCP yield minus the corresponding Libor rate, in basis points; ABCP yields for A1+ rated issues.

Sources: Federal Reserve Board; Bloomberg; BIS calculations.

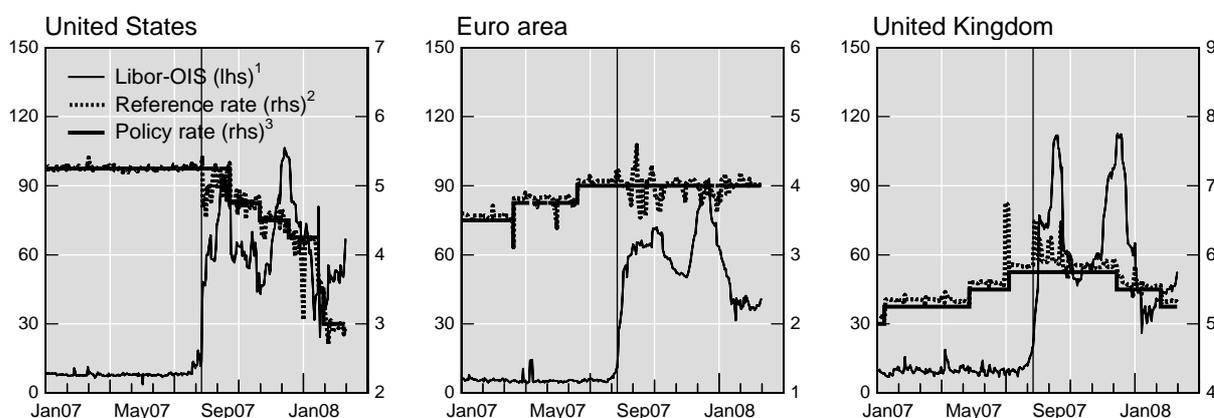
stating that “the complete evaporation of market liquidity” had made it “no longer possible to value fairly the underlying US ABS assets”.

It was on 9 August that the dislocations hit simultaneously and with full force the interbank markets of a number of mature economies, not least those in the United States and the euro area, ushering in a prolonged phase of tensions (Graph 8). These tensions took a variety of forms, including higher volatility in the overnight and longer rates, a sharp increase in the interbank rate risk premium beyond the shorter maturities, not least one to three months, a drop in volumes, signs of rationing and greater dispersion in pricing (Michaud and Upper (2008), Gyntelberg and Wooldridge (2008)). As banks began to hoard liquidity and became reluctant to lend to each other, the risk premium reflected a mix of liquidity and counterparty credit risks, in proportions that proved hard to disentangle.

Graph 8

### Interbank markets seize up

Three-month Libor–OIS spread (lhs) and money market rates (rhs)



The vertical lines indicate 9 August.

<sup>1</sup> Libor rate minus OIS rates (for the euro area, EONIA swap; for the United Kingdom, SONIA swap); in basis points. <sup>2</sup> For the United States, effective federal funds rate; for the euro area, EONIA; for the United Kingdom, overnight Libor. <sup>3</sup> For the United States, federal funds target rate; for the euro area, minimum bid rate in the main refinancing operation; for the United Kingdom, official Bank rate.

Sources: Bloomberg; BIS calculations.

The serious dislocations in the interbank market prompted an immediate response by central banks (Borio and Nelson (2008)). Indeed, news of large-scale exceptional injections of liquidity and public statements aimed at calming disorderly markets were the strongest signal that the turmoil had reached a new dimension. Central banks in a number of industrialised economies, including the United States, the euro area, Japan, the United Kingdom, Canada, Switzerland and Australia, adjusted their operations to ensure that they continued to implement their monetary policy effectively, retaining control over the relevant short-term rates, and to promote orderly conditions in the term market segment.<sup>3</sup> The measures culminated in coordinated action announced on 12 December, which included the setting-up of US dollar swap lines between the Federal Reserve, the ESCB and the Swiss National

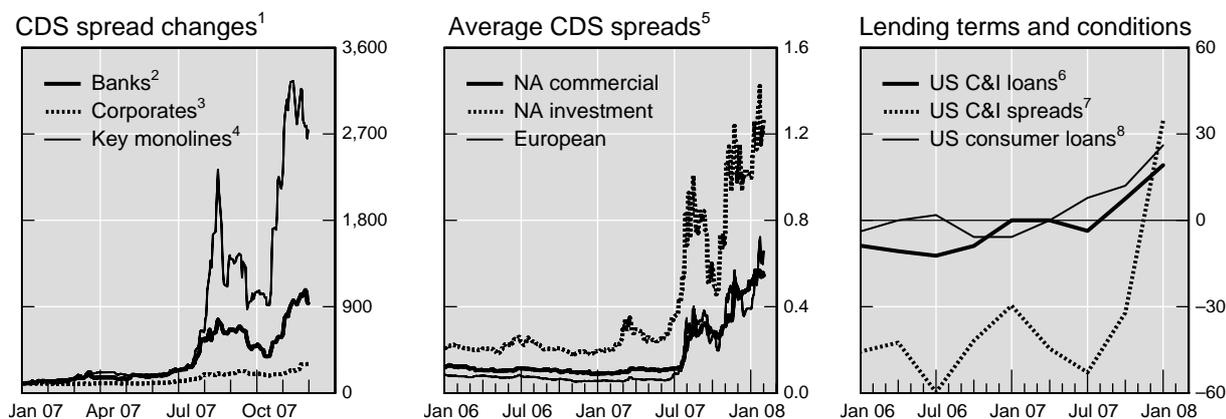
<sup>3</sup> To a degree that depended on the extent and nature of the dislocations and on the features of operating frameworks, measures included: increasing the size and frequency of the operations; adjusting terms on standing facilities, discretionary operations and arrangements influencing banks' demand for reserve balances; broadening the range of counterparties and eligible collateral; and lengthening the maturity of the liquidity injections.

Bank. These measures were partly intended to address a reintensification of tensions at year-end, owing to the usual seasonal pressures on liquidity.

Subsequent developments marked a gradual shift in the overt nature of the turmoil, from liquidity to asset quality concerns (BIS (2007d)). Liquidity tensions in the interbank markets and in money markets generally tended to ease, especially following year-end. By contrast, on balance, despite some waxing and waning in response to macroeconomic news and central bank actions, credit concerns tended to grow. This was reflected in a further, but more generalised, widening of credit spreads into the first two months of 2008, with the spreads measuring conditions in the housing market and the strength of financial institutions being particularly affected (Graph 9).

Graph 9

### Growing concerns about the financial sector



<sup>1</sup> Average of five-year CDS spreads; 1 January 2007 = 100. <sup>2</sup> Twenty large, internationally active banks from France, Germany, Japan, Switzerland, the United Kingdom and the United States (average rating of Aa2). <sup>3</sup> Twenty large industrial and consumer goods companies with the same country composition and average rating as the sample of banks described above. <sup>4</sup> Seven financial guarantors. <sup>5</sup> In per cent. The sample comprises eight commercial and six investment banks in North America (NA) and 11 universal banks in Europe. <sup>6</sup> Net percentage of domestic respondents tightening standards for commercial and industrial (C&I) loans for large and medium-sized firms seeking loans. <sup>7</sup> Net percentage of domestic respondents increasing spreads of loan rates over banks' cost of funds for large and medium-sized firms seeking loans. <sup>8</sup> Net percentage of domestic respondents tightening standards on consumer loans (excluding credit cards).

Sources: Federal Reserve Board; Markit; BIS calculations.

A number of factors were at work. Writedowns at financial institutions accumulated beyond expectations, with some institutions seeking (and managing) to raise external capital to replenish their buffers. Credit standards tightened further, beyond the sectors most directly affected by the turmoil. The situation in the US housing market continued to deteriorate. The ratings of monoline insurers came under growing pressure, threatening knock-on effects on the asset quality of the structured products and municipal securities that they insured. More generally, the macroeconomic outlook darkened, underlined by a series of macroeconomic announcements at the turn of the year that signalled a potentially serious deterioration in the US economy. In response to the worsening outlook, the Federal Reserve quickened the pace at which it had begun to ease policy in September, making an extraordinary 75 basis point inter-meeting cut on 22 January, followed by another 50 basis point cut eight days later.

### The next act(s)?

At the time of writing, the signs are that the financial strains will not disappear so easily. The recapitalisation of monoline insurers is proving difficult. In the United States, the problems experienced in the subprime mortgage market have continued to spread to other forms of household debt, both within the mortgage segment and beyond. In addition, there are

indications that the commercial real estate sector is weakening. The outlook in the leveraged loan market, in both the United States and Europe, is worsening, and default rates are expected to rise. A softening in economic activity has become visible also outside the United States, especially in those countries that have shared the features of the US expansion. The deleveraging process is bound to be painful. And the turn of the credit cycle is likely to remain a significant source of headwinds for the global economy.

Importantly, this is likely to occur even if there is no *independent* deterioration in the real economy. The processes underlying the turmoil have a dynamics of their own which point in that direction. One reason is the dynamics of property prices. In contrast to, say, equity prices, property prices exhibit considerable inertia (“positive serial correlation”), over and above their dependence on macroeconomic conditions (eg Borio and McGuire (2004), Zhu (2005), Davis and Zhu (2004)). This reflects mainly the fact that these markets do not “clear” as fast as those of other assets. Recent softness following the previous boom, therefore, is likely to be less responsive to any positive stimuli that may come from policy or the real side of the economy. A second reason is the dynamics of credit quality. There is a well known “seasoning” effect in credit quality whereby, other things equal, it normally takes two to three years before new credits go sour. Moreover, for reasons that will be discussed later, it is equally well known that the worst credits are granted towards the peak of the boom. And the revision in credit rating methodologies and the updating of inputs is likely to represent an additional source of pressure. A third, and equally well known, reason is the self-reinforcing dynamics of the credit-asset price cycle. Even disregarding any obvious self-reinforcing feedback effects with the real economy, credit availability and asset prices can feed on each other, both on the way up and on the way down, as theory, casual observation and more formal empirical evidence indicate.<sup>4</sup> Credit availability constrains the ability to turn perceptions of value into effective purchasing power; asset price valuations in turn influence the ability to obtain external funding.

## **2. The financial turmoil: a preliminary interpretation**

### **A characterisation**

At bottom, the characterisation of the dynamics of the financial turmoil is rather simple. The turmoil represented a sharp repricing of credit risk that, given the leverage built up in the system, led to, and was exacerbated by, an evaporation of liquidity in many markets, including in the interbank market. The repricing, which happened to have the US subprime mortgage market at its initial epicentre, followed a prolonged phase of broad-based and aggressive risk-taking. It was amplified by the great opacity of new instruments, such as structured credits, and of the distribution of exposures across the system. This led to a crisis of confidence in valuations, triggered by unexpected rating agency downgrades, and to a generalised distrust of counterparties, as market participants wondered about the size and character of their own exposures and of those of others. The crisis of confidence in turn triggered an evaporation of market liquidity for the instruments concerned and of funding liquidity for those institutions suspected of being vulnerable to the market disruption. As time passed, the underlying asset quality weaknesses inevitably became more evident.

Banks were affected for a number of reasons. For one, they had actually invested in subprime market securities directly, but this was a comparatively small part of the story. More importantly, they had provided backup credit lines for special purpose vehicles (SIVs and

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<sup>4</sup> On the theory, see eg Kiyotaki and Moore (1987) and Bernanke et al (1999); for some evidence, see eg Borio et al (1994), Davis and Zhu (2004) and Goodhart et al (2005).

conduits) that held those securities – vehicles which had grown very rapidly in previous years. And they could no longer count on markets to absorb underwritten credits (“warehousing risk”), be these in the form of mortgages or leveraged loans. As a result, banks became very concerned with the liquidity and capital implications of potential large-scale involuntary reintermediation, causing them to retrench. Even though the deterioration in the US subprime market was the key trigger of the financial turmoil, banks in several jurisdictions were faced with substantial liquidity pressures. In large part, these pressures arose because they had invested in subprime-related assets or were otherwise exposed to the drying-up of the market for ABSs.<sup>5</sup>

Beyond this characterisation, however, it is important to distinguish the idiosyncratic and new aspects of this episode of financial distress from the more systematic ones, which tend to be shared by all. It is to these aspects that we now turn.

### What is new?

So far, the two most salient idiosyncratic aspects of the current turmoil are the role of structured credit products and that of the O&D business model. The former has to do with the nature of new financial products; the latter with how the products are produced and disseminated within the financial system. Both have been the focus of attention in much of the recent policy debate. Consider each in turn.

The role of **credit structured products** has been so prominent that the recent turmoil is turning out to be the first major test of the resilience of the new credit risk transfer instruments spawned by the latest financial innovation wave. There are three interrelated specific characteristics of these products that may have contributed to the turbulence.

First, their payoffs can be highly non-linear (Fender et al (2008)). They tend to produce steady streams of returns in good times, but can result in heavy losses in bad times. In other words, their sensitivity to the more systematic aspects of the business cycle, such as asset prices and incomes, can be quite high, but cannot be perceived by investors for typical variations in the underlying variables in good times, as it is highly asymmetric and subject to strong threshold effects. Otherwise stated, they can have high “embedded leverage”.

Second, for similar reasons, the risk profile of structured products can be quite different from that of traditional bonds. As emphasised well before the turmoil in a number of official reports (eg CGFS (2005), Fender and Mitchell (2005)), it is common for tranches of structured products with the same expected (average) loss (or probability of default) as an individual bond to be exposed to a much higher probability of large losses (eg to have a higher “unexpected” loss or be exposed to higher “tail risks”). Since credit ratings only capture expected losses or probabilities of default, it can be highly misleading for investors to extrapolate the credit risk profile of these securities from those ratings.

Finally, modelling the future default and the risk profile of these instruments is itself subject to considerable uncertainty (Fender and Kiff (2005), Tarashev and Zhu (2007)). This reflects both the limitations of current models and difficulties in estimating key model parameters with any degree of confidence, especially given the short history of these products. Obtaining estimates of correlations of default is an obvious example. These shortcomings may be reflected in the prices at which the instruments trade and, where liquid markets do not exist, they imply that the corresponding marking-to-model point estimates are subject to a high degree of uncertainty.

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<sup>5</sup> Given that a number of these financing vehicles were funded in US dollars, even if actually located elsewhere, liquidity pressures were felt especially in this currency. This explains the scramble for US dollars by European institutions, particularly felt in FX swap markets, as they raised other currencies and swapped them into dollars (Baba et al (2008)).

These characteristics have likely played a role both during the build-up of risk-taking and during the turmoil. During the build-up, they may have contributed to lulling participants into a false sense of security. For instance, there is evidence that investors tended to rely excessively on credit ratings as indicators of risk. During the turmoil, these features no doubt contributed to the loss of confidence and the evaporation of market liquidity. They help to explain the virulent reaction triggered by the unexpected downgrades and by the equally unexpected large losses incurred on the instruments, as investors lost trust in the rating process and in observed valuations. The evaporation in market liquidity in turn forced firms to increase their reliance on marking-to-model, further amplifying the uncertainty surrounding the value of the instruments in stressful market conditions.<sup>6</sup>

The **O&D business model** is not new. After all, it is the very essence of investment banking. And it has been underpinning the growth of the syndicated loan market for many years. Even so, it has been particularly prominent in the current episode for two reasons. At least in the United States, it is the model that underlies the mortgage market, which is heavily securitised (Frankel (2006)). In addition, and more broadly, it is the model that, partly in order to economise on risk capital and balance sheet liquidity, has encouraged the setting-up of the special purpose vehicles in which exposures to structured products were often located.

Just like for structured products, the O&D model may have contributed both to the build-up of risk and to the turbulence that followed.

During the build-up, it may have added to the forces leading to an underpricing of risks. For one, several observers have noted the potential distortions of incentives in the O&D chain. They have pointed to reduced incentives to screen when originators sell off the credits granted and have noted the dispersion of responsibilities and potential conflicts of interest associated with long and complex chains from origination to ultimate investments (eg originators, brokers, vehicle sponsors, guarantors, rating agents, providers of backup liquidity lines, asset managers, etc).<sup>7</sup> Rating agencies, for instance, have come under significant criticism for possibly having compromised the integrity of their ratings in order to gain additional business, given their dual role as raters of the structured products and as consultants for their packaging. In addition, by appearing to disperse the risks in the system, the O&D model may have allowed the expansion of credit to go further than would otherwise have been the case. Not surprisingly, empirical evidence tends to confirm a positive correlation between the extent to which intermediaries rely on securitisation and their on-balance sheet credit growth (eg Altunbas et al (2007)).

When risks materialised, the O&D model added to the crisis of confidence. Given the opaqueness of the location of exposures in the system, uncertainty about the solidity of counterparties and investment vehicles caused agents to find safer harbours for their investments and to distrust counterparties. From being a vehicle for the distribution of risks and comfort in the system, securitisation now distributed fear.

The explosive mixture of new financial products and the O&D model largely explain the single most surprising element of the current turmoil, viz the amplitude of the involuntary reintermediation wave that threatened financial institutions, with its immediate and long-lasting dislocations in the interbank markets. This mix provided the raw material for the unprecedented size of the wave and the incentives to generate it.

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<sup>6</sup> In addition to being forced to rely more on marking-to-model, firms may have had an incentive to do so opportunistically, so as not to recognise the distressed prices prevailing in the markets.

<sup>7</sup> For some empirical evidence supporting this view in the US mortgage market, see Benjamin et al (2008). For an extensive and critical analysis of the securitisation chain, also with particular reference to the subprime mortgage segment, see Ashcraft and Schuermann (2008).

At the same time, this wave confirmed two trends that have been in evidence for quite some time, and which are unlikely to be reversed in the future.

The first is the increasingly tight symbiosis between intermediaries and markets (Borio (2003a, 2007a), BIS (2005), Knight (2007, 2008)). Admittedly, intermediaries and markets have often been seen as alternative forms of arranging financial relationships. In fact, however, they are highly complementary. Intermediaries such as banks have become increasingly reliant on markets as a source of income and for their risk management, through their hedging operations. Markets in turn have become increasingly dependent on intermediaries for the provision of market-making services and of funding liquidity (eg credit lines), which underpins their smooth functioning.

The second, which in part follows from the first, is the tight self-reinforcing link between market and funding liquidity (Borio (2003a)). This had already been evident in previous episodes of turbulence. For instance, it was highly prominent in the LTCM crisis of 1998, when, in the presence of counterparty risk, increases in margin requirements and cuts in credit lines (ie reductions in funding liquidity) exacerbated the evaporation of market liquidity. And banks have typically seen demands on their credit lines blow up when markets seize up, as highlighted by previous cases of problems in commercial paper markets, including as recently as in 2002, when the uncollateralised segment of the market came under strain.<sup>8</sup>

Thus, it is not the *mechanisms* behind the unprecedented involuntary intermediation wave that should have been surprising, but its *sheer size*. And this, in turn, is largely explained by the sheer size of the special purpose vehicles that had grown exponentially in recent years – a thinly capitalised “shadow banking system”, involved in large-scale liquidity and maturity transformation, that had escaped the attention of many, including in the official community.

### What is not new?

While the idiosyncratic aspects of the current turmoil are easily identifiable, those that it shares with previous such episodes are arguably more important, since they are likely to reflect the more enduring features of the dynamics of financial instability. As John Kay (2007), the British economist, has so aptly put it, drawing parallels between the current turmoil and some previous ones: “Each generation repeats the experience of its predecessors, not in broad outline but in considerable detail.”

All episodes of financial distress of a systemic nature, with potentially significant implications for the real economy, arguably have at their root an overextension in risk-taking and in balance sheets in good times, masked by the veneer of a vibrant economy. This overextension generates financial vulnerabilities that are clearly revealed only once the economic environment becomes less benign, in turn contributing to its further deterioration. The risk that builds up in good times simply materialises in adversity. The build-up and unwinding of financial imbalances is what can be termed the potential “excessive procyclicality” of the financial system (Borio et al (2001), Goodhart (2004)).<sup>9</sup>

As argued extensively elsewhere, there are basically four factors that can explain this overextension (Borio (2007a)). One is the asymmetric information that plagues all financial activity, particularly as between the ultimate users and providers of funds or between the

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<sup>8</sup> Ironically, the fact that the asset-backed segment escaped the episode largely unscathed was one reason why the ABCP segment grew as fast as it did in recent years, only to be at the core of the turmoil in the current episode.

<sup>9</sup> The term, in fact, is nothing but a more “modern” way of denoting those processes that, nuances aside, long-standing observers of financial instability such as Kindleberger and Minsky had already extensively and colourfully discussed in their writings (eg Kindleberger (1996), Minsky (1982)). For a recent analysis of the current turmoil that also emphasises similarities with previous ones along these lines, see Reinhart and Rogoff (2008).

parties to any trade. This generates considerable scope for conflicts of interest and principal-agent tensions that financial contracting can only partially address. This is true regardless of whether the transfer of funds occurs through “intermediaries” or “markets”.<sup>10</sup> A second is limitations in risk perceptions. This has to do with the fact that, for a number of reasons, it seems much harder to measure the time dimension than the cross-sectional dimension of risk, especially how risk for the financial system as a whole evolves over time (Borio et al (2001)). A third is limitations in incentives. Beyond those involved in the conflicts of interest noted above, the key limitation here refers to the fact that actions that are individually rational and compelling may not result in desirable aggregate outcomes. Familiar economic notions here are herding, coordination failures and prisoner’s dilemmas. This implies, for instance, that even when risks are recognised, it may sometimes be difficult for market participants to withdraw from the fray, as the short-term pain is not seen as offset by future potential gains.

The final factor is the strong positive feedback mechanisms that operate within the financial system and between the financial system and the real economy. A well known example is the potential self-reinforcing process that involves profitability, revealed risk appetite, asset prices, short-term volatility and market liquidity. Another one is the similar self-reinforcing process that involves the availability of and terms on external financing, asset prices and output. These feedback mechanisms highlight the true distinguishing feature of the financial system from any other sector. Elsewhere, an increase in supply tends to reduce the equilibrium price and is hence self-equilibrating. By contrast, in the financial sector, increases in the supply of funds (eg credit) will, up to a point, create their own demand, by making financing terms more attractive, boosting asset prices and hence aggregate demand. In a sense, a higher supply (of funding liquidity) ultimately generates its own demand.

These factors, especially the last three, can arguably help to explain a number of regularities. First, market indicators of risk, such as risk premia, tend to be comparatively low precisely before the peak of the financial cycle, when, in retrospect at least, it turns out that risk was highest. As Greenspan (2005) put it, “...history has not dealt kindly with the aftermath of protracted periods of low risk premiums”. Second, as noted earlier, underwriting standards become looser during particularly benign conditions in the more mature stages of credit booms, with the loans granted during those stages having the worst ex post default performance.<sup>11</sup> Finally, and probably most telling, there is also evidence that real-time indicators of financial imbalances, in the form of the coexistence of unusually rapid expansion in credit and asset prices, have useful predictive content for subsequent widespread financial distress, output weakness and disinflation, over horizons of two to four years ahead, depending on the calibration (Borio and Lowe (2002, 2004)). Moreover, such macro indicators can also help to improve the predictive content of popular micro models of default risk, including those widely used in the financial industry (Tarashev (2005)).

The implication of all this is simple. The build-up of risk in the financial system is especially insidious as the underlying mechanisms are highly non-linear. It is very much akin to the risk associated with the payoffs from the extension of guarantees or the writing of options: a steady premium paid upfront suddenly gives way to a large payment that offsets the previous receipts (Knight (2007)). The very build-up of tail risk generates the impression of stability. Extraordinary increases in asset prices raise the probability of their subsequent reversal, while the leverage that builds up in the system increases the vulnerabilities to that reversal. And yet, in the process, the system seemingly goes from strength to strength, appearing to validate the strong asset prices and risk premia.

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<sup>10</sup> Think, for instance, of the principal-agent and potential conflict of interest issues that arise in the underwriting of securities or in the offloading of assets from balance sheets (eg Hellwig (2007)).

<sup>11</sup> Some empirical work has documented this tendency as well as the broader tendency of rapid credit growth to go hand in hand with deteriorating credit quality (Jimenez and Saurina (2006), Foos et al (2007)).

The current turmoil has been no exception. For those who share the perspective just outlined, signs of excessive risk-taking were not hard to see; moreover, several observers, including in the official sector – the BIS among them – did not hold back warnings to that effect (eg BIS (2005, 2006, 2007a), Knight (2007)). The sustained global rapid increase in credit and asset prices, the exceptionally low risk premia and volatilities across asset classes, on the back of a widespread search for yield, and the accompanying evidence of a relaxation of underwriting standards and aggressive pricing were all unmistakable symptoms.

This analysis also has implications for the role of the idiosyncratic factors. They are themselves more symptoms than underlying causes. They are the specific form in which those causes happen to manifest themselves in a particular episode. For example, it is not surprising that some form of financial innovation typically has a role to play behind the turbulence. It is not just, or indeed mainly, that risks are harder to assess because the instruments or forms of finance are new. More to the point, these innovations increase the temptation to disregard the cautionary tales drawn from past experience, by providing yet another justification to discount it. The present, that is, is surely different from the past.<sup>12</sup>

From a broader perspective, arguably the episode in the postwar era that resembles most closely the current one is that which saw serious financial strains in mature economies at the start of the 1990s following the boom of the second half of the 1980s (Borio and Lowe (2004)). This is so especially if the 2000 bust in equity prices is equated to the 1987 stock market crash. Then, as now, a number of countries saw major expansions in credit and asset prices, with the monetary easing following the stock market crash helping to support the rapid increases in property prices that then weakened at the turn of the decade. Then, as now, the subsequent reversal caused strong headwinds in several mature economies. On that occasion, with some differences in timing, a number of outright banking crises followed.

To be sure, a number of significant differences are also apparent. In the current upswing, the household sector has been much more prominent. In the aggregate, corporate balance sheets are in better shape now, even though the current period has seen an LBO wave reminiscent of that of the 1980s (Borio (1990a,b)). Correspondingly, except for the last few years, the boom in property prices has been largely concentrated in the residential property segment; in the 1980s, both segments had been more generally affected. And banks have substantially higher levels of capital now than then, although judged by the “standalone” ratings, which strip out the impact of perceived external support, the differences in the health of balance sheets do not appear commensurately high (BIS (2007a)). Even so, the qualitative similarities are rather evident.

### **3. The financial turmoil: policy considerations**

This analysis has a number of implications for policy. The overarching one is that while it is tempting to address the most conspicuous problems highlighted by the present turmoil, there is a risk of focusing too much on the symptoms, rather than on the underlying causes. What follows identifies a number of areas in which measures may be desirable, outlining their strengths and limitations as well as the outstanding questions. The focus is not on how the turmoil should be managed, but on what policies could be put in place to strengthen the financial system on a longer-term basis, regardless of the specific sources of disturbances.

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<sup>12</sup> Similarly, it is all too easy to be too critical of the O&D business model. From a longer-term perspective, there are easily discernable cycles in the assessment of the merits of various forms of organisation of financial intermediation. In the 1980s, when Japan was booming, the bank-centred model was regarded as vastly superior to the market-centred model, only to be heavily discredited after the banking crisis there. The present criticism of market-centred finance is probably just as exaggerated as the unqualified praise that it received during the recent boom.

Three areas are considered in turn: accounting, disclosure and risk management; the architecture of prudential regulation; and monetary policy.<sup>13</sup>

### **Accounting, disclosure and risk management**

Accounting (or financial reporting) standards are a crucial element of the financial infrastructure: they are a key measuring rod for valuations, incomes and cash flows and the main vehicle through which this information is conveyed to the public. As a result, they are the basis for exercising market discipline.

Revisions in international financial reporting standards in recent years have been increasing the fair value accounting (FVA) elements in the arrangements. This has generated a heated debate concerning the merits of the trend. The debate has had a number of aspects. Some, as noted further below, concern the system-wide properties of this measurement system (macro level), including its potential procyclicality properties; others concern its firm- or instrument-specific properties (micro level).

As regards the latter, an aspect highlighted by the current turmoil is the wide margin of error, or the uncertainty, that can surround the valuations of instruments for which a liquid underlying market does not exist (or may evaporate at times of stress). To varying degrees, the valuation of these instruments relies on models (marking-to-model). That of complex products, in particular, depends quite heavily on these approximations. In previous work, we have argued that it is essential to complement such point estimates with measures that seek to provide some sense of the range of uncertainty that applies to them (Borio and Tsatsaronis (2004, 2006)).<sup>14</sup> The information would help to limit the risk of market participants being lulled into a false sense of security.

More generally, one could see this step as part of a broader, holistic strategy aimed at raising transparency in financial reporting and disclosure (Borio and Tsatsaronis (2004, 2006), Crockett (2002)). Such a strategy would distinguish clearly three dimensions of the information provided about any firm. The first is point estimates of current value, income and cash flows (“first moment information”). The second is the risk reflected in the statistical dispersion of future outcomes for these estimates (“risk information”). This is what is often captured through the probability distributions that underlie risk calculations (eg value-at-risk or cash-flow-at-risk measures). The third is the uncertainty, if any, associated with the imperfect measurement of the first two types of information (“measurement error”).<sup>15</sup> Such uncertainty applies with particular force to non-traded instruments. So far, efforts have mainly focused on the first and, increasingly, second dimensions of this information. While increasing, much more systematic attention could be paid to the third.<sup>16</sup>

This basic framework could also be applied to remedy some of the shortcomings of rating scales highlighted by the recent turmoil. As argued above, it is highly misleading to interpret

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<sup>13</sup> What follows does not discuss explicitly measures to strengthen the payment and settlement system infrastructure. It goes without saying that this aspect of the financial system should continue to receive close attention in policymaking, as it has for some time (Borio (2007a)).

<sup>14</sup> See also Crockett (2000) and Knight (2006). The classification of financial instruments (levels 1 to 3), based on the degree to which they rely on market inputs, envisaged in FASB Statement no. 157 is a welcome step in this direction.

<sup>15</sup> Measurement error, in turn, can arise from intentional misrepresentation or model error. Model error can be subdivided into errors in the choice of modelling approaches (“model error” proper) and in the estimation of parameters (“calibration error”). For a methodology to decompose model error into its constituent components with an application to credit risk, see Tarashev and Zhu (2007). Note that the three dimensions of the information apply to all forms of accounting, including accrual or historical accounting. Think, for instance, of the estimates of loan loss provisions.

<sup>16</sup> As argued in Borio and Tsatsaronis (2004, 2006), this holistic approach could itself be embedded in, and support, a much needed reconciliation between the perspectives of accounting authorities, risk managers and prudential regulators (see below).

current ratings as an adequate summary statistic for credit risk, given their exclusive focus on the first moment of the probability distributions. In revising their methodologies and rating categories, rating agencies could explore the possibility of setting up three-dimensional rating systems, covering, respectively, expected loss (probabilities of default), unexpected loss or tail risk,<sup>17</sup> and a measure of the confidence (margin of error) that surrounds the previous two classifications (Knight (2008)). Other things equal, the more complex the product and the shorter its history, the lower would be the degree of confidence in any specific rating. One advantage of such a system is that, given its generality, it could easily apply to any new product that came to the market, in principle keeping pace with financial innovation.<sup>18</sup>

The framework can also be used to classify the type of information concerning risk profiles of institutions that could be strengthened. The recent turmoil has highlighted the need to rebalance the focus of current disclosures, which pay considerable attention to credit and market risks but far less to (market and funding) liquidity risks. In particular, in a financial system that, as argued, is increasingly dependent on the robust availability of funding and market liquidity, greater attention to this type of information seems warranted and with considerable long-run payoffs. The benefits of such steps differ from those of more targeted disclosures about specific exposures, such as those currently being proposed for structured products. No doubt, transparency in this regard can help to re-establish confidence in the financial system, given its current plight. At the same time, it is very hard *ex ante* to identify what types of such targeted exposures can be useful, as the specific sources of future financial stress are hardly identifiable. Targeted efforts are better seen as complementary, *ex post* measures.

There is clearly considerable scope to improve risk management systems. The current turmoil has again highlighted how prevailing risk management processes have not yet succeeded in developing reliable stress tests. It is hard meaningfully to address the interaction between different types of risk and, above all, to incorporate the output of stress tests fully into firms' decision-making. How to address tail risks in a concrete way remains, and is likely to remain, a major challenge. More generally, in light of the limitations in risk perceptions discussed above, a source of concern is that, given the comparatively short horizon over which risks are measured and the way market inputs are used, prevailing risk measurement systems can result in excessively procyclical measures of risk. In effect, the measures behave more like thermometers, tracing risk as it materialises, rather than as barometers, gauging the likelihood of its future materialisation (Borio et al (2001), Lowe (2002), Borio and Shim (2007)). This can fail to provide sufficient resistance to the

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<sup>17</sup> It could be argued, however, that for an individual instrument, the concept of unexpected loss is less relevant, to the extent that the instrument's credit risk can be diversified away in a portfolio. Another possibility, probably best regarded as complementary, would be to provide a sense of the undiversifiable component, in the form of the sensitivity of the instrument's credit risk to a systematic, market-wide factor (eg, similar to a stock's beta in the CAPM). This is the source of tail risk in a portfolio sense and would help the investor assess the likelihood that defaults will occur together. See, eg Tarashev and Zhu (2007) for a way of estimating the sensitivity ("loading") to such a factor.

<sup>18</sup> Moreover, upon a moment's reflection, it is not difficult to think of traditional instruments, or combinations thereof, that would behave like tranches of structured products. In principle, the liability structure of a firm (or any portfolio of equivalent characteristics) can be thought of as such a complex product, as it combines instruments of different *seniority* that represent exposures to different portions of the distribution of returns associated with the firm's underlying assets. These assets, in turn, can be regarded as "bundles" of exposures/securities. And if the key characteristic of a CDO is seen as the *diversification* of the corresponding *idiosyncratic* credit risk component, then the more diversified the underlying income streams of the underlying assets, the closer the approximation to a CDO tranche will be (eg Amato and Remolona (2005)). For instance, senior claims that tend to default with a high probability only at times when many other defaults occur (eg which are highly sensitive to the *systematic* credit risk component, normally associated with the business cycle) would tend to behave like a senior tranche of a CDO. And the natural layering and interconnections of exposures in the financial system can easily result in tranche-type behaviour. What is new about these products is the *deliberate* packaging, putting together individual underlying instruments, and their *explicit valuation* with a view to selling them to investors. A useful analogy here is with options. It is well known that the equity (debt) of a firm can be regarded as a call (put) option on the underlying assets (Merton (1974)); in other words, traditional claims with option-like payoffs existed well before the creation of options as such.

build-up of risk and to cushion effectively its materialisation (see below). More thinking could be devoted to seeing how these shortcomings could be addressed.

Better information, greater transparency and improved risk management systems, however, can only go part of the way, and prove inadequate, unless incentives for prudent behaviour are strengthened, thereby addressing some of the incentive limitations noted above. From this perspective, an area that has so far not received the attention it deserves is compensation schemes (Rajan (2005), Heller (2008)).<sup>19</sup> Remuneration schemes that combine limited downside risk with high upside potential, that are unrelated to conservative ex ante risk measures, and, above all, that front-load payoffs can easily encourage excessive risk-taking. They have no doubt played a role in the recent build-up of risk, as in all previous ones. While fully acknowledging the serious difficulties involved, there is clearly scope to reflect further on how balanced compensation schemes might be encouraged (Knight (2008)).

### **The architecture of prudential frameworks**

In recent years, prudential regulation has been strengthened substantially. In particular, important strides have been made in the area of minimum capital standards. For banks, Basel II represents a major step forward compared with Basel I. Through Pillar I, it has greatly improved the treatment of the cross-sectional dimension of risk, by aligning capital charges much more closely with the relative riskiness of exposures. It has thereby greatly tightened the link between risk measures and minimum capital and reduced the scope for regulatory arbitrage. For example, had Basel II been in place in recent years, the exposures to conduits and SIVs through liquidity lines would have been much better captured. Through Pillar 2, it has substantially enhanced the scope for supervisors to require levels of capital above the minima, thereby allowing them to tailor the capital cushion to the risk incurred by individual institutions (“supervisory review”). Through Pillar 3, it has offered a tool to strengthen risk disclosures and market discipline. Above all, Basel II has helped to spread and hard-wire best risk management practice within the banking industry. Implementing Basel II should remain a priority.<sup>20</sup> Similar developments are taking place in insurance. And supervisors have been working for some time to promote greater convergence in supervisory practices, across both sectors and countries.

Beyond such important steps, an area that deserves attention is finding ways to strengthen further the macroprudential orientation of current frameworks. One key objective would be to address the limitations in risk perceptions and in incentives as well as the self-reinforcing processes that lie behind the generalised build-up of risk and financial imbalances, which are at the root of the more costly systemic crises. In the time dimension,<sup>21</sup> the basic principle would be to encourage the build-up of cushions in good times, when imbalances emerge, so that they can be run down, up to a point, in bad times, as the imbalances unwind.

Implementing the principle would have three merits. First, it would help to track the time dimension of risk more closely. While it has been common to think of risk as falling in booms and rising in recessions, it is better to think of it as rising in booms, if and when imbalances develop, and as materialising in the bust, as the disruptions unfold. Second, it would allow

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<sup>19</sup> Oddly enough, compensation packages drew a lot of attention at the time of the corporate malfeasance that was linked to the equity boom of the late 1990s; but the general question has not been squarely considered in the context of safeguards against excessive risk-taking in the financial system as such.

<sup>20</sup> Likewise, the Basel Committee's work under way on liquidity risks, which had been set in motion before the current turmoil, represents an additional welcome step, which could also help to reinforce risk disclosures in this area (BCBS (2008)).

<sup>21</sup> A macroprudential approach to financial regulation and supervision also has implications for the cross-sectional dimension of risk within the financial system, which are not discussed here. For a discussion, see Borio (2003b).

cushions to act as such. Unless they are run down, the buffers cannot perform their function. And in order to do so, the buffers need to be sufficiently high to start with; otherwise, forbearance would be inevitable. Finally, by leaning against the procyclical forces of the economy, it could limit the size of financial imbalances in the first place and hence the risk of subsequent financial instability and macro stress. It would act, that is, as a vital (soft) “speed limit” for risk-taking (Borio (2007a)).<sup>22</sup> Through all these mechanisms, implementing the principle would strengthen both individual institutions and the system as a whole.

As argued extensively elsewhere, there are a number of ways in which this principle can be implemented (Borio (2003b), Borio and Shim (2007), White (2006a)).<sup>23</sup> Built-in stabilisers would be superior to discretionary measures: provided they are related to reasonably robust aspects of the imbalances, built-in stabilisers leave less room for policy error; once in place, they do not require continuous justification, thereby acting as an effective pre-commitment device; and their presence can influence private behaviour *ex ante*. One set of such measures could calibrate prudential tools based on through-the-cycle or stress-test inputs. Examples include statistical loan provisioning, based on loan loss experience over several business cycles (eg as introduced by the Bank of Spain); conservative loan-to-value ratios, in terms of both the coefficient and the methodology for the valuation of the collateral; using inputs based on long-term averages or stress parameters in minimum capital requirements, such as the downturn losses-given-default (LGDs) required in Basel II; and through-the-cycle margining practices to address counterparty risk (eg Geithner (2006)). A more ambitious, and harder, step would be to seek to index some prudential tools to some of the most robust features of business or credit cycles. In addition, built-in stabilisers could be complemented with the occasional resort to discretionary measures, if and when found appropriate. This would permit to tailor the policy response to the specific characteristics of the imbalances, which vary in shape and size, such as in terms of the sectors affected. The possible measures range widely, but the basic principle is to tighten the calibration of the various prudential tools or the intensity of the supervisory review if the authorities suspect that imbalances are building up (eg through Pillar 2 of Basel II).

In recent years, considerable progress has been made in the direction of strengthening the macroprudential orientation of the frameworks (Crockett (2000), Knight (2006), Borio and Shim (2007)). Policymakers have become much more keenly aware of the importance of the macroprudential orientation, have made major efforts to upgrade the monitoring of potential vulnerabilities in ways consistent with it and have begun to use it more as a guide for calibrating prudential instruments, not least through discretionary measures. Even so, hurdles of an analytical, institutional and political economy nature still need to be addressed.

## Monetary policy

At the same time, there is a risk in relying exclusively on prudential policies to address financial imbalances as a source of financial and macro instability. Monetary policy, too, has a role to play, and not just in softening the impact of their unwinding, but also in constraining their build-up. Serious challenges are raised in both cases.

The potential role of monetary policy arises because of its influence on (funding) liquidity. Ultimately, the raw material on which prudential tools operate reflects perceptions of risk and value that can be less than fully adequate. In turn, these perceptions are intimately linked to the availability of liquidity, which allows them to be translated into purchasing power and hard

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<sup>22</sup> Technically, the distinguishing feature of the corresponding measures would be that their “shadow price” (how far they “bite” or constrain behaviour) increases with the build-up of the vulnerabilities and falls as they materialise.

<sup>23</sup> On the merits of the principle, see also Gieve (2008).

funding. But prudential authorities have only limited influence on the liquidity generated in an economy. Through its influence on interest rates and terms on access to external funding, this is largely the realm of monetary policy.

The main challenge for monetary policy is that financial imbalances can also build up in the absence of overt inflationary pressures. The latest episode is just one in a very a long series, going as far back as the gold standard era (Goodhart and De Lary (1999)). Moreover, in one respect the establishment of credible anti-inflation regimes may actually contribute to this conjunction of circumstances, by delaying the emergence of inflationary pressures which would otherwise signal the unsustainability of the economic expansion – the “paradox of credibility” (Borio and Lowe (2002)). The failure of inflation to rise may thus result in monetary authorities unwittingly accommodating the build-up of the imbalances.<sup>24</sup> While the ultimate source and driver of risk-taking need not be, and very often is not, monetary policy itself, its failure to adjust may eliminate a welcome brake on this form of behaviour.<sup>25</sup>

This suggests that it is important for monetary policy frameworks to allow for the possibility of tightening monetary policy even if near-term inflation remains under control – what might be called the “response option”. This would limit the risk of a painful macroeconomic adjustment further down the road, as the unwinding of the imbalances can result in macroeconomic weakness, broader financial strains, unwelcome disinflation and possibly even disruptive deflation.

In recent years, refinements in monetary policy frameworks have been consistent with this perspective (Borio (2007b)). At the same time, just as in the case of prudential policy, serious hurdles of an analytical, institutional and political economy nature exist. For example, issues such as the identification of the imbalances in real time, the calibration of the response, its consistency with mandates and its proper communication and justification are not easily addressed. Even so, the hurdles do not appear insurmountable (Borio and Lowe (2002)).

When the imbalances unwind, challenges are somewhat different. As in the build-up phase, one relates to adjustments in policy rates, ie in the monetary policy stance. In addition, as highlighted by the current turmoil, another one may relate to the central bank’s liquidity operations, which are aimed at implementing the policy stance and/or at responding to dysfunctional interbank market conditions. Consider each in turn.

In responding to the unwinding through changes in interest rates, the monetary authorities have to trade off two types of risk. One is responding too little and too late. This is the more familiar risk, most commonly and spectacularly associated with the Great Depression.<sup>26</sup> By allowing the self-reinforcing process to gather momentum, the authorities may fail to cushion the economic slide and the consequent financial strains and face a much tougher task to redress the situation, given the “non-linearities” involved. Indeed, in extreme cases, if the policy rate reaches the (nominal) zero lower bound, the effectiveness of policy may be crippled.

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<sup>24</sup> The point, of course, is not that monetary policy should “target” risk-taking, which would make little sense; rather, it is simply that monetary policy may sometimes fail to take properly into account its implications for the outlook for the real economy and for the inflation path over a sufficiently long horizon.

<sup>25</sup> At the same time, the possible influence of monetary policy on risk-taking, through its impact on risk perceptions and risk attitudes – what might be termed the “risk-taking” channel of the transmission mechanism – should not be underestimated. Think, of instance, of market participants’ frequent references to the role of low interest rates in contributing to the search for yield (BIS (2003), Rajan (2005)). For an analysis of this possible channel, see Borio and Zhu (2007).

<sup>26</sup> This general view, however, needs to be nuanced somewhat. Policy was rather responsive in the early phase, as suggested by movements in the discount rate, an admittedly incomplete indicator. The discount rate (New York Bank’s rate) fell from 6% to 2.5% from October 1929, when the stock market crashed, to June 1930, and thereafter only much more gradually, to 1.5% by May 1931. Subsequently, no adjustment was made until policy was actually *tightened*, partly to safeguard external convertibility, in October of the same year. Liquidity management operations, however, did remain rather restrictive throughout.

The other risk is responding too much too quickly and, above all, for too long. A specific concern here is that the response, while possibly successful in the short run, may work only at the expense of generating further financial imbalances. At some point, their subsequent unwinding would generate larger costs further down the road. Certain elements of this story can be traced in the experience of the 1980s–early 1990s boom-bust, following the easing that took place in response of the stock market crash (Borio and Lowe (2004)), and also in the recent cycle, following the response to the high-tech equity market bust (Borio (2007b)). Arguably, the main source of difficulty here is not so much the intensity and speed of the initial response, but the lack of speed with which interest rates are returned to more normal, long-run equilibrium levels (an “exit problem”). Paradoxically, low inflation can be a hindrance here, by seemingly retarding the need for, and making it harder to justify, the “normalisation” of policy rates, to levels more in line with the long-term growth potential of the economy.

There is, here, a new form of so-called “time inconsistency”, whereby a sequence of apparently optimal responses given the conditions at the time may not be optimal if taken as a whole. While this issue has become very familiar as a possible factor explaining the failure to control inflation, it can also arise, in a novel form, in the context of financial imbalances. Market participants’ perceptions that central banks may cushion the unwinding of the imbalances but fail to restrain their build-up could contribute to it, by inducing higher risk-taking. Articulating a fully satisfactory answer to this problem remains a challenge.<sup>27</sup>

Adjustments to liquidity operations may be needed whenever the unwinding of financial imbalances causes shock waves to the interbank market. On the one hand, this can threaten the effective implementation of a given monetary policy stance. Specifically, it can make it hard to ensure that some short-term market rate, generally an overnight rate, is consistent with the policy rate announced by the central bank (eg the federal funds rate target in the United States or the minimum bid rate in the euro area). On the other hand, it can inhibit the proper functioning of the market, as most visibly reflected in the risk premium on interbank rates. Contrary to popular belief, addressing these problems effectively is not really an issue of *how much* central bank liquidity to inject, on a cumulative net basis, in the system. Because of the way monetary policy is implemented, the required cumulative net injections need not increase much, if at all. It is primarily a question of ensuring a proper *distribution* of central bank liquidity, alleviating funding constraints on the institutions that are most affected. In other words, liquidity management operations need to address the frictions and obstacles in the distribution of funds in the interbank market, thereby also alleviating funding liquidity constraints more broadly (Borio and Nelson (2008)).

This raises a number of technical and more fundamental issues. First, aspects that are often taken for granted in normal times acquire critical significance, such as the range of eligible collateral and counterparties as well as cross-country and cross-currency differences in these respects. Likewise, instruments that may operate smoothly under normal conditions may prove inadequate when most needed. One such notable example is when institutions become reluctant to borrow from the central bank standing facility for fear of signalling weakness to the market (the “stigma” problem). Second, it is not clear how far it is desirable or feasible to affect the risk premium at longer maturities through liquidity management operations. In other words, how far, and at what terms relative to the market’s, should the central bank pursue the intermediation role required for this purpose? Third, and more generally, the rule book for interventions designed to address liquidity gridlocks in markets has yet to be written. One such issue, for instance, is that of moral hazard. In the case of solvency crises policymakers have developed a consensus on a set of guiding principles. In particular, while ensuring an orderly resolution, shareholders, management and, to the extent possible, creditors should be allowed to incur losses. No such clear principles exist as yet

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<sup>27</sup> For an analysis that emphasises these aspects, see White (2006b).

when the problems originate in markets, as opposed to specific institutions, and take initially the form of a generalised liquidity crunch, so that responsibilities are more diffused. These issues have already started to command the attention of central banks, and will no doubt continue to do so in the future.

## Conclusion

The unfolding financial turmoil in mature economies has darkened the outlook for the global economy and prompted the official and private sectors to reconsider policies, business models and risk management practices. Regardless of its future evolution, it already threatens to become one of the defining economic moments of the 21st century. This essay has attempted to provide a preliminary assessment of the events and to draw some lessons for policies designed to strengthen the long-term soundness and resilience of the financial system.

The financial turmoil has had a number of highly prominent idiosyncratic elements. It has been the first real stress test of the innovation wave of credit risk transfer instruments, in particular credit structured products, which had gathered momentum in recent years. It has also brought to light some limitations of the originate-and-distribute model as it had developed over the last few years. These two factors likely contributed to the build-up of risk-taking and to the intensity of the turmoil. During the build-up, they probably helped to weaken underwriting standards and to lull participants into a false sense of security. As the turmoil erupted, they exacerbated the crisis of confidence that underpinned the evaporation of market and funding liquidity, not least by heightening uncertainties about both valuations and the location of risks in the financial system. Together, they thus help to explain the single most surprising element of the current turmoil, viz. the unprecedented amplitude of the involuntary reintermediation wave that threatened financial institutions, with its immediate and long-lasting dislocations to the interbank markets.

And yet, these idiosyncratic elements, prominent as they are, should not blind us to the more fundamental nature of the turmoil and to the factors behind it. The turmoil should best be seen as the unwinding of broad-ranging financial imbalances that built up over a prolonged period of aggressive risk-taking, overstretching balance sheets against the backdrop of a strong global economy, rapidly rising asset prices and credit expansion, and unusually low interest rates. History suggests that the aftermath of such conditions can result in costly financial strains for the macroeconomy. These occasional episodes can be regarded as reflecting the potential excessive “procyclicality” of the financial system. At the root of such tendencies lie self-reinforcing processes within the financial system and between the financial system and the real economy as well as limitations in risk perceptions and in incentives.

Policies to strengthen the financial system on a sustainable basis, while naturally taking into account the specific weaknesses brought to light by the current turmoil, should be firmly anchored to the more enduring factors that drive financial instability. In this essay, a number of areas for action have been highlighted. They include: strengthening transparency, including with specific reference to measures of the uncertainty that surrounds point estimates of value, to multi-dimensional rating classifications and to liquidity risks; encouraging improvements in risk management systems, not least seeking to limit the procyclicality of risk measures; reflecting further on how to promote more prudent compensation schemes; strengthening the macroprudential orientation of prudential frameworks, building on the important improvements in minimum capital regulation yielded by Basel II; and refining monetary policy frameworks so as to take better account of both the build-up and unwinding of financial imbalances, including by ensuring effective liquidity

management operations at times of stress. Working along these lines holds out the promise of helping to limit the incidence of serious episodes of financial distress in the future.

## References

Amato, J and E Remolona (2005): “The pricing of unexpected credit losses”, *BIS Working Papers*, no 190, November.

Ashcraft, A B and T Schuermann (2008) “Understanding the Securitization of Subprime Mortgage Credit”, Federal Reserve Bank of New York Staff Reports, no 318, March.

Altunbas, Y, L Gambacorta and D Marqués (2007): “Securitisation and the bank lending channel”, *ECB Working Paper Series*, no 838, December.

Baba, N, F Packer and T Nagano (2008): “The spillover of money market turbulence to FX swap and cross-currency swap markets”, *BIS Quarterly Review*, March, pp 73–86.

Benjamin, J, T Mukherjee, A Seru and V Vig (2008): “Did securitization lead to lax screening? Evidence from subprime loans 2001-2006”, mimeo.

Bernanke, B, M Gertler and S Glichter (1999): “The financial accelerator in a quantitative business cycle framework”, in J Taylor and M Woodford (eds), *Handbook of Macroeconomics*, Amsterdam.

Bank for International Settlements (2003): *73rd Annual Report*, June.

——— (2005): *75th Annual Report*, June.

——— (2006): *76th Annual Report*, June.

——— (2007a): *77th Annual Report*, June.

——— (2007b): “Overview: markets rebound after sell-off”, *BIS Quarterly Review*, June, pp 1–13.

——— (2007c): “Overview: credit retrenchment triggers liquidity squeeze”, *BIS Quarterly Review*, September, pp 1–16.

——— (2007d): “Overview: markets hit by renewed credit woes”, *BIS Quarterly Review*, December, pp 1–17.

Basel Committee on Banking Supervision (2008): *Liquidity risk: management and supervisory challenges*, February.

Borio, C (1990a): “Leverage and financing of non-financial companies: an international perspective”, *BIS Economic Papers*, no 27, October.

——— (1990b): “Banks’ involvement in highly leveraged transactions”, *BIS Economic Papers*, no 28, October.

——— (2003a): “Market distress and vanishing liquidity: anatomy and policy options”, in A Persaud (ed), *Liquidity black holes: understanding, quantifying and managing financial liquidity risk*, Risk Publications, December. Also available (revised and updated) as *BIS Working Papers*, no 158, 2004.

——— (2003b): “Towards a macroprudential framework for financial supervision and regulation?”, *CESifo Economic Studies*, vol 49, no 2/2003, pp 181–216. Also available as *BIS Working Papers*, no 128, February.

——— (2007a): “Change and constancy in the financial system: implications for financial distress and for policy”, in Reserve Bank of Australia (ed), *Financial system: structure and*

*resilience, Proceedings of a conference*, Reserve bank of Australia, Sydney. Also available as *BIS Working Papers*, no 237, October.

——— (2007b): “Monetary and prudential policies at a crossroads? New challenges in the new century”, *Moneda y Crédito*, 224, pp 63–101. Also available as *BIS Working Papers*, no 216, September 2006.

Borio, C, C Furfine and P Lowe (2001): “Procyclicality of the financial system and financial stability: issues and policy options” in “Marrying the macro- and micro-prudential dimensions of financial stability”, *BIS Papers*, no 1, March, pp 1–57.

Borio, C, N, Kennedy and S Prowse (1994): “Exploring aggregate asset price fluctuations across countries: measurement, determinants and monetary policy implications”, *BIS Economic Papers*, no 40, April.

Borio, C and P Lowe (2002): “Asset prices, financial and monetary stability: exploring the nexus,” *BIS Working Papers*, no 114, July.

——— (2004): “Securing sustainable price stability: Should credit come back from the wilderness?”, *BIS Working Papers*, no 157, April.

Borio, C and P McGuire (2004): “Twin peaks in equity and housing prices?”, *BIS Quarterly Review*, March, pp 79–93.

Borio C and W Nelson (2008): “Monetary operations and the financial turmoil”, *BIS Quarterly Review*, March, pp 31–46.

Borio, C and I Shim (2007): “What can (macro)-prudential policy do to support monetary policy?”, in Bank of Thailand (ed), *Inflation targeting in emerging market countries, Proceedings of a conference*, Bank of Thailand, 13–14 November 2006. Also available as *BIS Working Papers*, no 242, December.

Borio, C and K Tsatsaronis (2004): “Accounting and prudential regulation: from uncomfortable bedfellows to perfect partners?”, *Journal of Financial Stability*, vol 1, issue 1, September, pp 111–35. A more extensive version is also available as “Accounting, prudential regulation and financial stability: elements of a synthesis”, *BIS Working Papers*, no 180, September 2005.

——— (2006): “Risk in financial reporting: status and suggested future directions”, *BIS Working Papers*, no 213, August.

Borio C and H Zhu (2007): “Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?”, paper prepared as a keynote presentation for the ECB conference on “The implications of changes in banking and financing on the monetary policy transmission”, 29–30 November, Frankfurt.

Committee on the Global Financial System (2005): *The role of ratings in structured financed: issues and implications*, January.

——— (2006): *Housing finance in the global financial market*, Basel, January.

Crockett, A (2000): “Marrying the micro- and macroprudential dimensions of financial stability”, *BIS Speeches*, 21 September.

——— (2002): “Financial reporting: from shadows to limelight”, *BIS Speeches*, 13 June.

Davis, E P and H Zhu (2004): “Bank lending and commercial property cycles: some crosscountry evidence”, *BIS Working Papers*, no 150, March.

Fender, I and J Kiff (2005): “CDO rating methodology: some thoughts on model risk and its implications”, *Journal of Credit Risk*, vol 1, no 3. Also available as *BIS Working Papers*, no 163, November 2004.

- Fender, I and J Mitchell (2005): "Structured finance: complexity, risk and the use of ratings" *BIS Quarterly Review*, June, pp 67–79.
- Fender, I, N Tarashev and H Zhu (2008): "Credit fundamentals, ratings and value-at-risk: CDOs versus corporate exposures", *BIS Quarterly Review*, March, pp 87–101.
- Foos, D, L Norden and M Weber (2007): "Loan growth and riskiness of banks", mimeo.
- Frankel, A (2006): "Prime or not so prime? An exploration of US housing finance in the new century", *BIS Quarterly Review*, March, pp 67–78.
- Geithner, T (2006): "Hedge funds and derivatives and their implications for the financial system", Remarks at the Distinguished Lecture 2006, sponsored by the Hong Kong Monetary Authority and Hong Kong Association of Banks, Hong Kong SAR.
- Goodhart, C (2004): Some New Directions for Financial Stability?, The Per Jacobsson Lecture, Zurich, Switzerland, 27 June.
- Goodhart, C and P De Lary (1999); "Financial crises: plus ça change, plus c'est la même chose", LSE Financial Markets Group Special Paper, no 108.
- Goodhart, C, B Hofmann and MA Segoviano (2005): "Default, credit growth and asset prices", paper presented at the conference on "Financial Stability – Central Banking and Supervisory Challenges", IMF Institute, Washington DC, 6–7 September.
- Greenspan, A (2005): "Reflections on central banking", remarks at "The Greenspan Era: Lessons for the Future" – Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 25–27 August.
- Gyntelberg, J and P Wooldridge (2008): "Interbank rate fixings during the recent turmoil", *BIS Quarterly Review*, March, pp 59–72.
- Heller, D (2008): "Three ways to reform bank bonuses", *Financial Times*, 3 February.
- Hellwig, M (2007): "Financial intermediaries and financial markets", paper presented at the 6th BIS Annual Conference, Brunnen, 18-19 June.
- Jimenez, G and J Saurina (2006): "Credit cycles, credit risk, and prudential regulation", *International Journal of Central Banking*, June, pp 65–98.
- Kay, J (2007): "The same old folly starts a new spiral of risk", *Financial Times*, 14 August, London edition.
- Krahen J P and C Wilde (2008): "Risk Transfer with CDOs", mimeograph.
- Kiyotaki, N and J Moore (1997): "Credit cycles", *Journal of Political Economy*, vol 105, pp 211–48.
- Kindleberger, C (1996): *Manias, panics and crashes*, Cambridge University Press, Cambridge, 3rd edition.
- Knight, M D (2006): "Marrying the micro and macroprudential dimensions of financial stability: six years on", speech delivered at the 14th International Conference of Banking Supervisors, BIS Speeches, October.
- (2007): "Now you see it, now you don't: risk in the small and in the large", speech delivered at the Eighth Annual Risk Management Convention of the Global Association of Risk Professionals, 27–28 February.
- (2008): "Now you see it, now you don't: the nature of risk and the current financial turmoil", speech delivered at the Ninth Annual Risk Management Convention of the Global Association of Risk Professionals, 26–27 February.
- Lowe, P (2002): "Credit risk measurement and procyclicality", *BIS Working Papers*, no 116, September.

- Merton, R C (1974): "On the pricing of corporate debt: the risk structure of interest rates", *Journal of Finance*, vol 29, pp 449–70
- Michaud, F-L and C Upper (2008): "What drives interbank rates? Evidence from the Libor panel", *BIS Quarterly Review*, March, pp 47–58.
- Minsky, H P (1982): "Can "it" happen again?", *Essays on Instability and Finance*, Armonk: M E Sharpe.
- Rajan, R J (2005): "Financial markets, financial fragility, and central banking", paper presented at "The Greenspan Era: Lessons for the Future" – Symposium sponsored by the Federal Reserve Bank of Kansas City; Jackson Hole, Wyoming, 25–27 August.
- Reinhart, C and K Rogoff (2008): "Is the 2007 US sub-prime financial crisis so different? An international historical comparison", mimeo.
- Tarashev, N (2005): "An empirical evaluation of structural credit risk models", *BIS Working Papers*, no 179, July.
- Tarashev, N and H Zhu (2006): "Measuring portfolio credit risk: modelling versus calibration errors - *BIS Quarterly Review*, March.
- (2007): "Measuring portfolio credit risk: modelling versus calibration errors", *BIS Quarterly Review*, March, pp 83-96.
- White, W (2006a): "Procyclicality in the financial system: do we need a new macrofinancial stabilisation framework?", *BIS Working Papers*, no 193, January.
- (2006b): "Is price stability enough?", *BIS Working Papers*, no 205, April.
- Zhu, H (2005): "The importance of property markets for monetary policy and financial stability", in *Real Estate Indicators and Financial stability*, *BIS papers*, no 21, pp 9–29.

## Annex 1: Chronology of events

Date	Event
<b>2007</b>	
2 April	New Century Financial Corporation, the second-largest subprime mortgage lender in the United States, files for Chapter 11 bankruptcy. This follows significant strains (losses, search for an acquirer, and some bankruptcies) at more than two dozen smaller subprime lenders in February and March.
3 May	UBS announces the closure of its internal Dillon Read hedge fund, following some \$125 million in subprime-related losses.
14 June	Rumours surface that two Bear Stearns-managed hedge funds invested in securities backed by subprime mortgage loans have incurred heavy losses and that \$3.8 billion of high-quality ABS bonds are up for sale to raise cash for margin calls.
15 June	Moody's downgrades the ratings of 131 ABSs backed by subprime home loans and places about 250 bonds on review for downgrade.
18–19 June	Bear Stearns is rumoured to be engaged in negotiations with lenders among Wall Street banks to save its two hedge funds; some lenders proceed and seize collateral.
20–22 June	News reports confirm that the two Bear Stearns-managed hedge funds are close to being shut down; Merrill Lynch auctions off seized collateral (20/6). One of the troubled hedge funds is kept open through an injection of \$3.2 billion in loans, the other one is to be liquidated in an "orderly fashion" (22/6).
25 June	Cheyne Capital says it lost \$75 million on subprime exposures.
10–12 July	S&P places \$7.3 billion worth of 2006 vintage ABSs backed by residential mortgage loans on negative ratings watch and announces a review of CDO deals exposed to such collateral; Moody's downgrades \$5 billion worth of subprime mortgage bonds (10/7). Moody's places 184 mortgage-backed CDO tranches on downgrade review; further reviews and downgrades are announced by all major rating agencies in the following days (11/7). Fitch places 33 classes from 19 structured finance CDOs on negative watch (12/7).
24–26 July	US home loan lender Countrywide Financial Corp reports a drop in earnings and warns of difficult conditions ahead (24/7). The NAHB index indicates that new home sales slid by 6.6% year on year in June; DR Horton, the largest homebuilder in the United States, reports an April–June quarter loss (26/7). Absolute Capital, an Australian hedge fund, freezes withdrawals (26/7).
30 July–1 August	Germany's IKB warns of losses related to the fallout in the US subprime mortgage market and reveals that its main shareholder, Kreditanstalt für Wiederaufbau (KfW), has assumed its financial obligations from liquidity facilities provided to an ABCP conduit exposed to subprime loans (30/7). Further losses exposed at IKB lead to a €3.5 billion rescue fund being put together by KfW and a group of public and private sector banks (1/8). Bear Stearns freezes withdrawals from a third hedge fund (1/8).
31 July	Moody's reports that the loss expectations feeding into the ratings for securitisations backed by Alt-A loans will be adjusted.
31 July–6 August	American Home Mortgage Investment Corp announces its inability to fund lending obligations (31/7) and, one week later, files for Chapter 11 bankruptcy (6/8). Union Investment, a German fund manager, stops withdrawals from one of its funds after investors pull out about 10% of its assets (3/8).
8 August	Three ABCP programmes, including one for an American Home conduit, extend the maturities of their liabilities, the first ever extensions of such programmes.
9 August	BNP Paribas freezes redemptions for three investment funds, citing an inability to appropriately value them in the current market environment.

9 August-	The ECB injects €95 billion of liquidity of overnight funds into the interbank market, signalling the beginning of a set of extraordinary moves, and announces that it is "closely monitoring markets and stands ready to act to assure orderly conditions in the euro area money market" (9/8). The Federal Reserve conducts three extraordinary auctions of overnight funds injecting a total of \$38 billion and issues a similar statement to the ECB (10/8). Either on 9 August or soon afterwards, other central banks begin to take similar steps.
13–15 August	CP market disruption in Canada (13/8). Four more US ABCP programmes extend maturities and two are downgraded by Fitch (15/8). Goldman Sachs injects 43 billion into its GEO hedge fund.
16 August	Moody's downgrades 691 2006 vintage subprime second-lien bonds; Countrywide draws \$11.5 billion in liquidity commitments.
17 August	The Federal Reserve's Open Market Committee issues a statement noting that the downside risks to growth have increased appreciably; the Federal Reserve Board approves a 50 basis point reduction in the discount rate and announces that term financing will be provided for up to 30 days.
21 August	S&P downgrades two SIV-lites and places two other on negative watch.
28 August	S&P downgrades CP and medium-term notes issued by SIV Cheyne Finance.
5 September	Moody's also downgrades Cheyne Finance-issued notes and places the ratings of four other SIV-issued note programmes on negative watch.
13 September	Northern Rock seeks emergency liquidity assistance from the Bank of England.
18 September	The Federal Reserve Board cuts the federal funds rate target by 50 basis points.
19 September– 4 November	First string of news of writedowns and quarterly losses at major financial institutions. A number of high-profile CEOs leave their positions and top management reorganisations take place.
10 October	Hope Now Alliance, a cooperative effort between the US government, counsellors, investors, and lenders to help homeowners who may not be able to pay their mortgages, is established.
11–19 October	In total, Moody's and Standard & Poor's each downgrade more than 2,500 subprime mortgage bonds, worth some \$80 billion in original face value.
15 October	Citigroup, Bank of America and JP Morgan Chase announce the setting-up of an \$80 billion fund (called MLEC) to support the ABCP market by buying assets from SIVs.
22–23 October	Standard & Poor's puts 590 ABS CDOs on negative watch (22/10) and downgrades 145 tranches of CDOs worth \$3.7 billion (23/10); Moody's downgrades 117 CDO tranches later the same week, and Fitch places some \$37 billion worth of CDOs under review, heralding further large-scale rating actions in the following weeks.
24 October– 5 November	Various financial guarantors announce third quarter net losses; Fitch announces that it is considering cutting the AAA rating of certain monoline insurers.
25 November– 13 December	HSBC announces that it plans to take \$45 billion in SIV assets back onto its balance sheet (25/11). WestLB and HSH Nordbank support \$15 billion of SIVs, Citibank plans to take \$49 billion of SIV assets on its balance sheet (13/12).
26 November	Citigroup to raise \$7.5 billion from the Abu Dhabi Investment Authority.
10 December	UBS raises CHF13 billion in Tier 1 capital from GIC and an investor from the Middle East.
11 December	The Federal Reserve Board cuts the federal funds rate by 25 basis points.
12 December	Several central banks (Federal Reserve, ECB, Bank of England, Bank of Canada, Swiss National Bank) announce a number of coordinated measures designed to make turn-of-the year funding available to a larger number of institutions and against a broader set of collateral. These include, inter alia, putting in place US dollar swap lines between the Federal Reserve and the ECB (\$20 billion) and the Swiss National Bank (\$4 billion). The Bank of Japan and the Riksbank express explicit support for those measures.

19 December	ACA, a financial guarantor rated A, is downgraded by S&P to CCC, triggering collateral calls from its counterparties for which repeated waiver periods are negotiated during the following months; S&P's rating outlooks for other monolines are lowered from stable to negative; Barclays sues Bear Stearns for fraud and deception, for having allegedly hidden losses in a fund in which Barclays had invested. Morgan Stanley announces that its fourth quarter results include an additional \$4.7 billion of mortgage-related writedowns in November beyond those that had been announced at the end of October and it raises \$5 billion from the Chinese Investment Corporation.
21 December	The MLEC ABCP rescue fund plan is abandoned by its sponsoring banks.
24 December	Merrill Lynch raises up to \$6.2 billion in capital from Temasek Holdings and Davis Selected Advisors.
<b>2008</b>	
2–4 January	Weak purchasing managers' data (02/01) and labour market reports (04/01) point to a marked weakening in the US economy and trigger fears about global growth.
14–28 January	The Federal Reserve, ECB and Swiss National Bank carry out additional long-term funding operations in US dollars; the Bank of England conducts the second extended operation of three-month funds against wider high-quality collateral in domestic currency.
15 January	Citigroup announces a fourth quarter loss, partly due to \$18 billion of additional writedowns on mortgage related exposures. This ushers in another string of similar news from other financial institutions in subsequent weeks.
18–30 January	Fitch downgrades Ambac by two notches from AAA (18/1) and also downgrades SCA to A (24/01) and FGIC to AA (30/01). Some 290,000 insured issues, mostly municipal bonds but also structured products, are downgraded as a result. S&P downgrades FGIC to AA on 31 January and further rating actions by all three major rating agencies are taken on the monolines in the following weeks.
21–30 January	The Federal Reserve Board implements a 75 basis point extraordinary inter-meeting rate cut (22/01), following broad-based global equity and credit market weakness (21/01). Societe Generale announces a \$7.2 billion loss on equity positions linked to fraudulent activity by a rogue trader (24/2). Another 50 basis point cut follows a week later (30/1).
13 February	President Bush announces an economic stimulus package.
13-28 February	AIG reports increasing loss estimates by more than \$4 billion on a portfolio of super-senior credit default swap exposures after modifying the valuation methodology (13/2). Later in the month it announces a \$11.1 billion writedown on subprime mortgages for the fourth quarter of 2007, the largest one among insurance companies (28/2).
19 February	Credit Suisse announces a \$2.8 writedown on structured credit products due to "pricing errors", prompting a review of its 2007 results, following their release a few days before.
25–26 February	MBIA completes a \$1.1 billion stock sale; S&P (25/02) and Moody's (26/02) subsequently confirm its credit rating as Aaa/AAA with negative outlook.
28 February	Peloton Partners announce the closure of a \$2 billion ABS fund and temporarily halt redemptions from another fund, following margin calls by lenders.

Sources: Bloomberg; Financial Times; FitchRatings; The Wall Street Journal; company press releases.