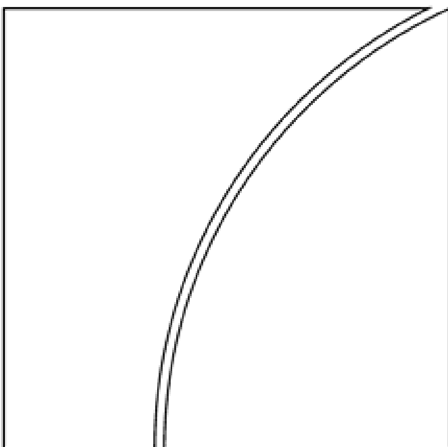
Committee on the Global Financial System



CGFS Papers

No 31

Central bank operations in response to the financial turmoil

Report submitted by a Study Group established by the Committee on the Global Financial System

This Study Group was chaired by Francesco Papadia of the European Central Bank

July 2008

JEL Classification numbers: E42, E52, E58

BANK FOR INTERNATIONAL SETTLEMENTS

Copies of publications are available from:

Bank for International Settlements
Press & Communications
CH 4002 Basel, Switzerland

E mail: publications@bis.org

Fax: +41 61 280 9100 and +41 61 280 8100

This publication is available on the BIS website (www.bis.org).

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ISBN 92-9131-769-1 (print)

ISBN 92-9197-769-1 (online)

Preface

In November 2007, the Committee on the Global Financial System (CGFS), in cooperation with the Markets Committee, convened a Study Group to examine how central banks adapted the ways in which they supplied liquidity in response to the money market tensions that emerged in August 2007 and how effective those responses were. This Study Group, chaired by Francesco Papadia (European Central Bank), brought together senior central bank market operations experts from seven major currency areas. A number of other CGFS central banks also contributed to the analysis.

The first draft of the Study Group report was completed in February 2008. In its March 2008 meeting, the CGFS discussed the draft report and endorsed the preliminary recommendations identified at that stage. After approval by the G10 Governors, the preliminary recommendations served as input for the April 2008 Financial Stability Forum (FSF) report to the G7 Finance Ministers and central bank Governors. The draft Study Group report, including its recommendations and conclusions, was subsequently revised and updated in the light of the significant and rapidly evolving developments in March and April 2008.

The Study Group worked in real time, so to speak. The report was drafted while central banks closely monitored market developments and, more or less simultaneously, had to respond to the evolving challenges. Indeed, some of the specific recommendations discussed by the Study Group had already been implemented during the drafting period. Moreover, the report reflects the Study Group's experience and assessment up to end-April 2008, at which time market tensions were still persisting. Central banks, both individually and collectively in the CGFS and other forums, are continuing to draw lessons from the turmoil about the operation of their liquidity facilities and to examine how they can be made more effective now and in the future. A particular focus of our ongoing investigations in the CGFS is the cross-border provision of liquidity.

Donald L Kohn

Chairman, Committee on the Global Financial System
Vice Chairman, Board of Governors of the Federal Reserve System

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Executive summary

A deterioration in credit market conditions in 2007, led by the crisis in the US subprime mortgage market, resulted in acute balance sheet pressures, funding constraints and heightened counterparty risk concerns among major banks and financial institutions. This in turn prompted a sustained period of uncertainty in money market conditions and wider term money market rate spreads for a number of major currencies. In response, central banks took a variety of measures in order to calm short-term interest rate volatility and to address various types of funding market pressures. This report was produced by a Study Group convened in November 2007 by the Committee on the Global Financial System (CGFS), in cooperation with the Markets Committee, to examine the effectiveness of central banks' responses to the liquidity tensions.

With regard to the various central bank actions taken (Section 3), one observation is that the degree to which central banks adjusted their monetary operations reflected both the severity of the turmoil in their respective regions and the design of their pre-existing operational frameworks. Overall, the various actions can be seen as tackling the situation on four fronts. First, central banks acted to keep short-term money market rates in line with their policy rates (or targets) through more active reserve management, assuring banks of their orderly access to overnight funds. Second, central banks sought to ease pressures in the broader funding markets by (1) increasing the average maturity of refinancing provided to banks; (2) expanding, where needed, the range of eligible collateral and counterparties; and (3) increasing the scope of securities lending. Third, central banks increased their cooperative efforts both through enhanced communication and collective market monitoring, and through coordinated actions to provide longer-term funds. Finally, in parallel with being more proactive, innovative and cooperative in liquidity management, some central banks also calibrated their monetary policy stance to take into account any impact the unfolding credit market turmoil might have on inflation and real activity.

With regard to the outcomes (Section 4), experience up to end-April 2008 suggests that the various central bank actions have reduced, though not resolved, tensions in money markets. This alleviation of tensions, even if incomplete, was judged in turn to have mitigated the potential damage for the economy from the broader financial market turmoil. Overall, the most tangible result was that central banks were able to keep short-term market rates close to their policy rate targets, notwithstanding the more volatile market conditions, as well as the stigma associated with standing lending facilities, which might have, in some cases, complicated central banks' efforts. Of course, addressing funding market pressures in the broader sense, particularly in term unsecured markets, was much more difficult. Indeed, the assessment of central banks about their ability to deal with such market pressures depends crucially on the pressures' origins: how much came from liquidity concerns, which are amenable to central bank actions, and how much from counterparty risk or other concerns, which are beyond the reach of central bank operations. Overall, the judgment was that tensions would have been more acute and more damaging without the forceful interventions of central banks. Last but not least, central bank communication was judged largely successful, especially in distinguishing liquidity management actions from monetary policy changes. Nonetheless, given that there were some cases of misunderstanding about the details of policy implementation, there could be room for improvement.

The report closes with a summary of the conclusions drawn from the experience and sets out seven corresponding recommendations (Section 5):

1. Financial turmoil may give rise to two distinct developments that can each make it more difficult for central banks to keep the relevant interest rates near the policy rate targets: first, there may be unpredictable shifts in the aggregate demand for reserves; second, there may be occasions on which a central bank needs to extend large amounts of credit but at the same time keep the net aggregate supply of

reserves consistent with its policy rate target. In either case, the operational framework should still be capable of achieving the desired policy rate target.

2. Impaired functioning of the interbank money market can result in a poor distribution of central bank reserves, which can exacerbate tensions in money markets beyond the aggregate disturbances identified in the conclusion above. In order to distribute reserves effectively when the interbank market is impaired, central banks should be capable of conducting operations with an extensive set of counterparties and against a broad range of collateral.

3. In a period of financial turmoil, illiquid conditions may pose a grave threat to the effective transmission of monetary policy and to financial stability. In such circumstances, central banks should be prepared to expand their intermediation activities and, if needed, take steps that go beyond adjusting the aggregate supply or distribution of reserves.

4. Channels for distributing liquidity across borders may become impaired in times of financial turmoil. To prepare for that possibility, central banks should take steps to strengthen their capacity to counter problems in the international distribution of liquidity. Possible steps include establishing or maintaining standing swap lines among themselves and accepting – or developing and maintaining the ability to accept – foreign currency denominated assets or obligations booked abroad as collateral in their operations.

5. Misinformation and misinterpretation of central bank actions are more likely and costly in times of stress. During such periods, central banks should enhance their communication with market participants and the media.

6. In stressed situations, the stigma associated with standing lending facilities may become acute, thereby reducing their efficacy as backup sources of funding. Central banks should continue their efforts to reduce stigma by, for example, enhancing the understanding of the role of such facilities and designing new facilities that are less associated with past instances of emergency assistance.

7. The expectation that central banks will act to attenuate market malfunctioning may create moral hazard by weakening market participants' incentives to manage liquidity prudently. Central banks should carefully weigh the expected benefits of actions to re-establish liquidity against their potential costs and, where necessary, introduce or support safeguards against the distortion of incentives.

While these recommendations seem to the Study Group to be advisable, the specific ways that central banks may choose to implement them will depend upon the circumstances and the individual central bank's situation. In any event, the Study Group is aware that the recommendations it identified cannot deal with the root causes and pervasive effects of the market turmoil, which go beyond the sphere of central bank actions.

1. Introduction

In November 2007, the Committee on the Global Financial System, in cooperation with the Markets Committee, convened a Study Group to examine how central banks adapted their operations in response to the money market tensions that emerged in August 2007 and how effective those responses were. This report documents the findings that the Study Group was able to reach as of end-April 2008, taking into account that the turmoil was still ongoing at the time of writing.

Overall, the central banks' responses were judged to be largely effective in alleviating the money market tensions brought about by problems in the broader financial system. However, these responses could not, and were not intended to, address the underlying causes of these problems, which lay beyond the scope of central banks' normal operations. In addition, the experience during this turbulent period offered abundant material worthy of central bank review. In some cases, such review has already led to a revision of central bank instruments, but further changes could be on the horizon.

The rest of the report is organised as follows. Section 2 briefly reviews the emergence of money market tensions, brought about by the broader financial market turmoil, and their subsequent evolution. Section 3 outlines the various central bank actions taken in response. Section 4 provides an assessment of the effectiveness of these actions. Finally, Section 5 summarises the conclusions drawn from the experience and sets out a number of recommendations.

Although the financial market turmoil had a global reach, its impact on money markets varied markedly across different regions of the world. Accordingly, this report will focus on the regions that experienced particularly acute disturbances, namely North America and Europe. The analysis of the reasons underlying such cross-regional differences is largely outside the scope of this report, except insofar as some differences might be due to variations in central banks' operations.

2. The emergence of liquidity tensions[1]

During the second half of 2007, the deterioration in the performance of subprime mortgages in the United States resulted in a loss of confidence in structured finance products and prompted a broad repricing of asset-backed securities (ABS) collateralised by mortgages. Problems in the ABS market soon spilled over to the market for asset-backed commercial paper (ABCP). Growing awareness about the use of mortgages and residential mortgage-backed securities (RMBS) – including the subprime variety – as collateral for some ABCP issues made investors, including open-ended money market funds facing redemption risk, reluctant to roll over maturing ABCP in many segments of the market. This investor retrenchment led some ABCP issuers to draw on liquidity support facilities at sponsoring banks or invoke options to lengthen the maturity of their paper. Meanwhile, the significant repricing of mortgage-backed securities (MBS) undercut investors' confidence in the credit ratings of existing structured products backed by subprime mortgages, and eventually those backed by other assets as well. Issuance of collateralised debt obligations (CDOs) of ABSs declined sharply, as did the issuance of many other structured credit instruments.

[1] For a more detailed account of the evolution of the financial turmoil, see the Overview section of the September 2007 and subsequent issues of the *BIS Quarterly Review*.

All these developments rendered banks more uncertain about their future funding needs as well as their ability to meet such needs in a timely fashion and at reasonable cost. At the same time, uncertainty over the extent and distribution of subprime and structured finance related losses raised concerns about counterparty credit risks. As a result, commercial banks and other money market investors became exceptionally cautious in their liquidity management. Furthermore, the rising prospects of having to take some off-balance sheet exposures back onto balance sheets also led some banks to cut back on credit extension.

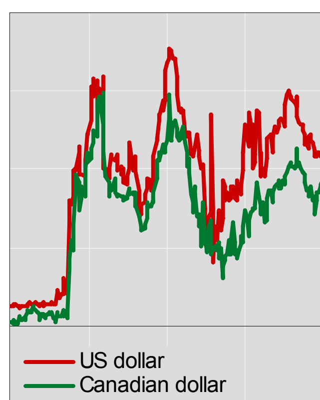
Reflecting the increased caution and skittishness, banks' demand for reserves at central banks became less elastic and more volatile. In early August 2007, the overnight interbank rates in the United States and Europe came under upward pressure. Furthermore, time zone frictions led to large swings over the day in the demand for US dollar interbank funds. Since European banks have few local sources of dollar funding, they preferred to secure funds from the interbank market early in the US trading session. However, US banks with an excess reserve position preferred to defer lending until later in the trading day, when their net funding position became more certain. This mismatch exacerbated the upward pressure on the US dollar overnight interbank rate in the European mornings.

Graph 1

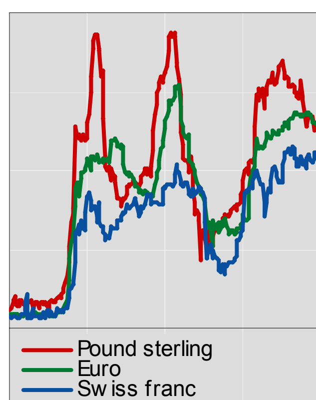
Three-month Libor-OIS spreads[1]

In basis points

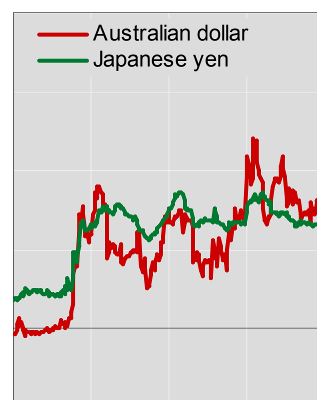
North America



Europe



Asia-Pacific



[1] Three-month Libor minus three-month overnight index swap (OIS) rates.

Source: Bloomberg.

Other market segments were also affected. The spreads on term money market rates relative to expected policy rates widened sharply as investors became hesitant to invest in unsecured money markets at anything other than the shortest horizons. Term funding pressures also led to a deterioration in the liquidity in the foreign exchange swap market as uncertainty affected the forward rates used to set the terms of such swaps. This loss of liquidity in turn made it more difficult for banks to use funds raised in non-dollar markets to meet dollar obligations.

The tensions in money markets came in several waves (Graph 1). After subsiding to some degree in late September 2007, money market strains increased again in November, this time exacerbated by year-end funding needs. Market participants bid aggressively for funds with terms that extended into 2008 in order to avoid the risk of funding shortfalls in the final days of the year. At the same time, market participants became even more reluctant to lend, in order to maintain a high degree of balance sheet liquidity. As a result, year-end premia jumped to levels not seen since the 2000 century date change. Adding to the market

tensions were growing concerns over the soundness of some major financial institutions that had suffered sizeable subprime and related credit losses and thus a rise in perceived counterparty risk. As it turned out, however, the end of the year passed without major difficulties, partly because of the central bank actions described in Section 3.

Money market tensions intensified again in early March 2008, as the financial turmoil showed signs of worsening and spreading. Mounting writedowns and losses among large financial institutions and the threats of rating downgrades among monoline bond insurers raised significant counterparty credit concerns. This in turn undermined liquidity in a broad range of credit markets. In some cases, major banks cut credit lines to financial firms and demanded larger haircuts on collateral. Amid more frequent margin calls, the forced selling of assets into already thin markets stoked fears of a deleveraging spiral and of imminent solvency problems among financial firms. In the credit market, nervousness reached a high point in mid-March when the near-bankruptcy of a major US investment bank required its speedy acquisition by a larger rival, facilitated by emergency credit assistance from the Federal Reserve. Credit markets calmed down considerably towards late March. However, in the money market, tensions rose ahead of the March quarter end and remained elevated in April.

3. Central bank actions

Central banks responded to strains in interbank markets by adjusting their market operations in a variety of ways (Table 1).[2] The degree to which central banks adjusted their monetary operations reflected both the severity of the turmoil in their respective regions and the design of their pre-existing operational frameworks.[3] Overall, the various actions can be seen as tackling the situation on four fronts. The first response and primary objective of central banks was to try to keep short-term money market rates in line with their policy rates (or targets) through more active reserve management, thus assuring banks of their orderly access to overnight funds. Second, central banks sought to ease pressure in term money markets and repo markets by (1) increasing the average maturity of refinancing provided to banks; (2) expanding, where needed, the range of eligible collateral and counterparties; and (3) increasing the scope of securities lending. Third, central banks increased their cooperative efforts, initially through enhanced communication and collective monitoring of market developments, and later through coordinated actions to provide longer-term funds. Finally, in parallel with being more proactive, innovative and cooperative in liquidity management, some central banks also calibrated their monetary policy stance to take into account any impact the unfolding credit market turmoil might have on inflation and real activity.

3.1 Keeping short-term money market rates near policy targets

At the onset of money market tensions in August 2007, the operational responses of central banks mainly aimed at countering the unstable demand for central bank reserves and thus keeping money market rates in line with policy targets. The Reserve Bank of Australia (RBA), the Bank of Canada (BoC), the European Central Bank (ECB), the Bank of Japan (BoJ), the Swiss National Bank (SNB), the Federal Reserve and, from September, the Bank of England (BoE) conducted market operations that were either outside their regular schedule (ie fine-tuning) or in larger than usual amounts (see Annex 1). Other measures, such as reminding or

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[2] Annex 1 provides a chronology of selected central bank actions in response to the turmoil.

[3] Information on central bank monetary policy frameworks is available in “Monetary policy frameworks and central bank market operations”, prepared by members of the Markets Committee, December 2007.

assuring market participants of the accessibility of overnight standing lending facilities and accommodating a higher level of reserves holding, were also used to help contain overnight rate volatility and to balance the supply of and demand for central bank reserves at the policy rate. Overall, central banks did not inject more reserves (on average over a maintenance period, where applicable) than needed to maintain market rates near policy targets.

Table 1

Special measures taken during the financial turmoil[1]

	AU	CA	EA	JP	CH	GB	US
Exceptional fine-tuning (frequency, conditions)	✓	✓	✓	✓	✓	✓	✓
Exceptional long-term open market operations	✓	✓	✓	✓	✓	✓	✓
Front-loading of reserves in maintenance period	•	•	✓		✓		
Change in reserve requirements/targets	•	•				✓	
Change in the standing lending facility							✓
Broadening of eligible collateral	✓	✓			✓[2]	✓	✓
Broadening of counterparties						✓[3]	✓
Introducing or increasing securities lending						✓	✓

AU = Australia; CA = Canada; EA = euro area; JP = Japan; CH = Switzerland; GB = United Kingdom; US = United States. ✓ = yes; blank space = no; ● = not applicable.

[1] Table reflects information up to end-April 2008. [2] Entered into effect on 1 October 2007, but not linked to the turmoil. [3] Only for four special auctions of term funding announced in September 2007, for which, however, there were no bids.

Source: Central banks.

3.2 Addressing pressures in funding markets

In addition to keeping short-term market interest rates in line with policy rates, central banks also sought to address the pressures in funding markets. To alleviate the continued strains in term money markets, for instance, central banks took two main approaches. The indirect approach was to reassure financial institutions of the adequate supply of overnight funding. By increasing financial institutions' confidence in their ability to fund themselves reliably in the overnight market, this approach could potentially increase these institutions' willingness to extend term loans in the market. The abovementioned liquidity management measures to keep short-term market rates stable around policy targets contributed to this effect. The move by the Federal Reserve to enhance the attractiveness of its standing loan facility was also a step in this direction. The spread between its lending rate (the discount rate) and the federal funds rate target was narrowed from 100 basis points to 50 basis points in mid-August 2007, and then to 25 basis points in mid-March 2008.[4]

The more direct approach was to increase the provision of term funds through market operations. The ECB started in August 2007 to conduct supplementary three-month refinancing operations and in March 2008 announced two six-month refinancing operations

[4] Moreover, the maximum allowable term on such loans was increased from overnight to 30 days, and subsequently to 90 days.

to be conducted in April and July. The SNB carried out its first ever three-month repurchase transaction on 13 September 2007 and offered other term transactions as needed in the subsequent months. The RBA, the BoJ, the Federal Reserve and the BoE also expanded their provision of term funds. The participation of the ECB and SNB in supplying term US dollar funding (see Section 3.3), in coordination with the Federal Reserve's new Term Auction Facility (see below), was an innovative variation on the same theme.

An important complementary development was that several central banks widened, either temporarily or permanently, the range of eligible collateral and, in some cases, counterparties so as to facilitate an effective distribution of central bank funds. The BoC announced special operations in August 2007 that accepted temporarily as collateral all securities that were already eligible for its standing liquidity facility, and conducted some term repo operations in December and early 2008 that accepted a wider than normal range of collateral.[5] From September 2007, the RBA widened the list of collateral eligible for its regular repo operations and its overnight repo facility to include a broader range of bank paper, as well as RMBS and ABCP. Though not directly a response to the market turmoil, the SNB also announced in mid-August 2007 an expansion of its eligible collateral list with effect from 1 October. The BoE offered four special three-month tenders in late September and October 2007 against a wider range of collateral and to a wider set of counterparties. As part of the coordinated central bank actions announced in December 2007 (see Section 3.3), the BoE also widened the collateral list in and increased the size of its regular three-month repo operations.[6] Also in the same joint announcement, the Federal Reserve introduced the Term Auction Facility (TAF), which provides via biweekly auctions one-month loans against discount window collateral to a very wide range of banks.[7]

Measures were also taken to improve the financial sector's access to liquidity in a broader sense. The Federal Reserve introduced two new facilities for primary dealers in mid-March 2008 in order to encourage the smooth functioning of repo markets. In the Term Securities Lending Facility (TSLF), primary dealers can borrow US Treasury securities for up to 28 days against certain agency-guaranteed and other high-quality private MBS, in addition to collateral eligible for regular open market operations (OMOs).[8] The Primary Dealer Credit Facility (PDCF) offers primary dealers overnight discount window loans against certain investment grade debt securities as well as collateral for regular OMOs.[9] In April 2008, the BoE introduced the Special Liquidity Scheme, a facility in which banks can swap high-quality but temporarily illiquid assets for UK treasury bills. The asset swaps can be undertaken at any point within a six-month drawdown period and have terms of one year (renewable to up to three years). Since only "legacy" assets that existed as of end-2007 are eligible for the

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[5] As part of its ongoing review of collateral policy, the BoC also decided to broaden the range of securities acceptable under the Standing Liquidity Facility to include certain types of ABCP (end-March 2008) and US Treasuries (expected by mid-2008).

[6] The widened collateral list includes AAA-rated RMBS and covered mortgage bonds

[7] The TAF is available to all depository institutions (institutions with reservable deposits): commercial banks, savings and loans, savings banks and credit unions; and also to US branches and agencies of foreign banks. The funds are extended against discount window collateral: most securities and loans on the books of depository institutions, including assets denominated in the major foreign currencies and many assets booked abroad. This setup contrasts with the regular open market operations, which are conducted with the 20 primary securities dealers only and against a narrower set of collateral (Treasury or US government agency securities, including agency-guaranteed MBS).

[8] The existing securities lending programme (SOMA) lends securities for an overnight term and only against securities eligible for regular open market operations (Treasuries, agencies, and agency MBS).

[9] Prior to the introduction of the PDCF, the Federal Reserve had not extended discount window loans to non-depository institutions since the 1930s.

swap, the Scheme aims to improve the liquidity position of the banking system, not to finance new assets.

3.3 Increasing cooperative efforts

The financial market turmoil prompted central banks to have much more frequent and detailed discussions about market developments and the technical aspects of their market operations, both bilaterally and collectively. Such enhanced cooperation took place both at the Governors level and at the experts level. The Bank for International Settlements served as a forum in this respect. Communication across central banks intensified as the turbulent episode evolved over time.

Central banks also acted in concert on some occasions. Although coordinated action had been considered already in August 2007, the first such action took place later in the year, amid heightened market tensions arising from year-end funding pressures. The central banks of five currency areas (BoC, ECB, SNB, Fed and BoE) jointly announced on 12 December 2007 a number of coordinated measures to provide term funding. Two other central banks – the BoJ and the Riksbank – joined the announcement to indicate their support. A key element was the establishment of swap lines between the Federal Reserve, on the one hand, and the ECB and the SNB, on the other. This allowed the two central banks in continental Europe to conduct US dollar auctions during European trading hours to help alleviate time zone frictions and to complement the Federal Reserve's TAF auctions. Moreover, the swaps respected the principle that the home central bank should, whenever practical, be the provider of funds to banks in its jurisdiction, given that it generally has better information about the borrower's needs and underlying financial conditions. Other measures in the joint announcement included additional term repo operations by the BoC to serve year-end needs and an expansion of the amount of three-month funds to be offered at the BoE's scheduled long-term OMOs in December and January.[10]

The same group of central banks issued a second joint announcement of further actions on 11 March 2008. The transatlantic swap lines established in December were increased in size and were extended in term to end-September 2008. The ECB and SNB, after suspending term US dollar auctions in February 2008 amidst improved dollar liquidity in Europe, resumed conducting auctions in March.[11] In the same announcement, the BoC and BoE published their plans to conduct further term repo operations later in March and in April, while the Federal Reserve introduced the TSLF.

3.4 Adjusting the monetary policy stance

Central banks were careful to distinguish between actions aimed at addressing market strains and monetary policy moves. Nonetheless, the consequences of the broader financial market turmoil did factor importantly into the policy decisions of central banks. And those decisions had, in turn, significant effects on market conditions, in part by countering expectations of an economic slowdown.

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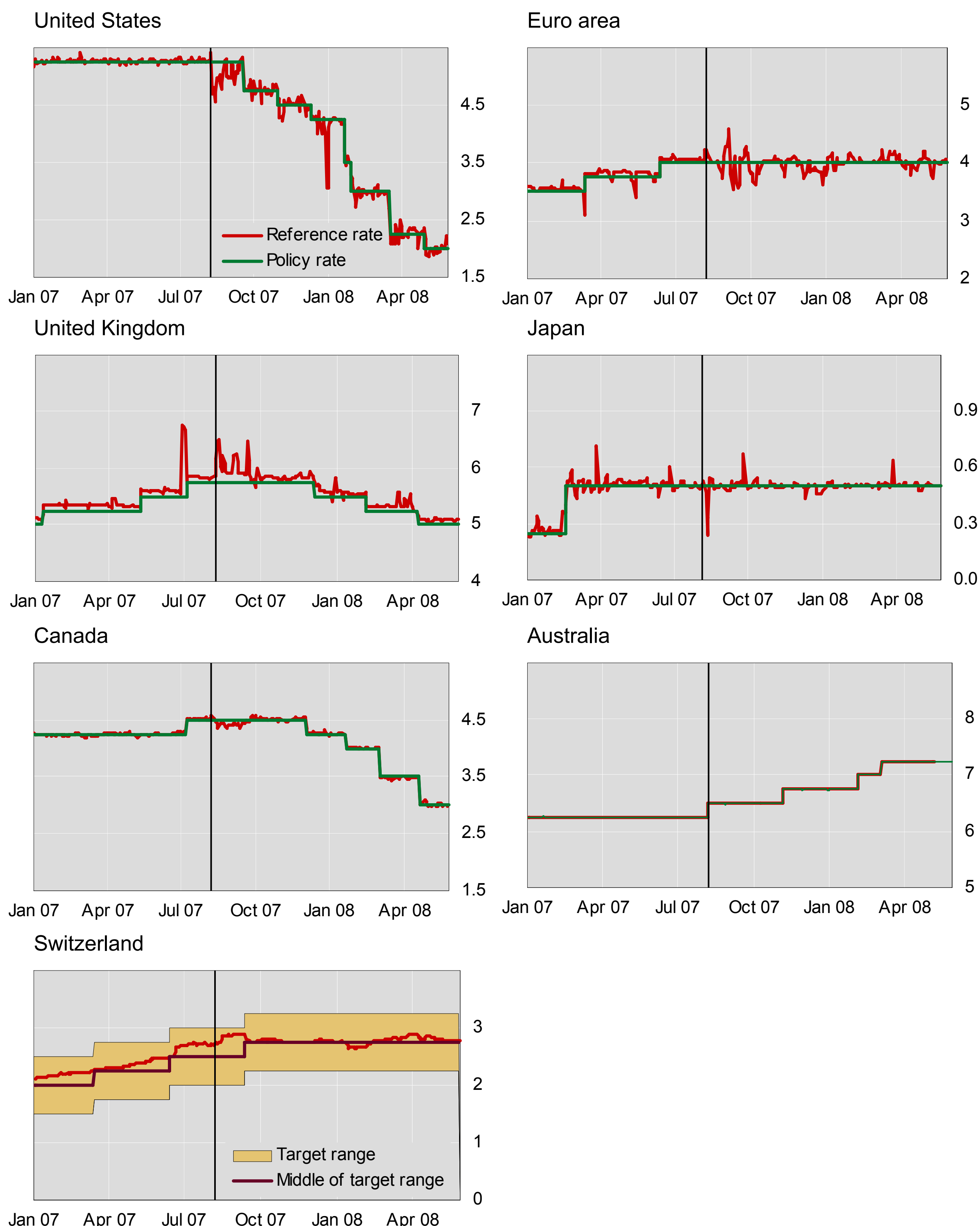
[10] Both central banks accepted broader ranges of collateral in these operations.

[11] On 2 May 2008, both central banks announced further increases in the total amount of their US dollar offers. The ECB increased the size of its biweekly auctions to USD 25 billion each. The SNB increased the frequency of its auctions from monthly to biweekly, while keeping the size at maximum USD 6 billion each. The size and term of their swap lines with the Federal Reserve were also adjusted accordingly.

Graph 2

Reference market rates and policy rates[1]



[1] In per cent. For Australia, overnight unsecured lending rate and target cash rate; for Canada, overnight repo and overnight target rate; for the euro area, EONIA and minimum bid rate in the main refinancing operation; for Japan, uncollateralised overnight call rate and uncollateralised target rate; for Switzerland, three-month Libor and three-month Libor target range; for the United Kingdom, overnight Libor and official Bank Rate; for the United States, effective federal funds rate and federal funds target rate. The vertical lines indicate 9 August 2007.

Source: Bloomberg.

In several instances, the weakening macroeconomic outlook led central banks to follow a policy path that was easier than had been expected prior to the turmoil. After noting in an intermeeting statement on 17 August 2007 that downside risks to growth had increased appreciably, the Federal Open Market Committee (FOMC) cut the federal funds target rate by 50 basis points at its September meeting. Over the following seven months (October to April), the FOMC lowered its target rate by an additional 275 basis points (Graph 2). Although widely expected to tighten policy at its September 2007 meeting to counter inflationary pressures, the ECB Governing Council left its key policy rate unchanged at that meeting, as well as in subsequent months, citing the high level of uncertainty in the outlook. Likewise, the BoJ kept its policy rate on hold and continued to monitor movements in global financial markets as well as the global economic developments behind them. The BoE kept its policy rate unchanged in the September 2007 policy meeting, citing a recent easing in inflation and the need to monitor the evolution of both the price and quantity of credit, and reduced its policy rate by 3/4 percentage point between December and April. The BoC also held policy steady in September 2007, despite prior expectations of tightening, and began to ease policy in December. After raising its target band for the three-month Swiss franc Libor to 2.25–3.25% in September 2007, the SNB also kept policy on hold in the December and March meetings.[12]

In contrast, in some of the other economies, the financial market turmoil did not affect the outlook sufficiently to warrant an easier monetary policy stance. The RBA, for example, in fact continued to raise its target cash rate several times between August 2007 and early 2008. The Riksbank also continued along the previous policy path, raising its repo rate in late 2007 and early 2008.

4. Results

Experience up to end-April 2008 suggests that the various central bank actions outlined above have reduced, though not resolved, tensions in money markets. This alleviation of tensions, even if incomplete, should in turn have contributed to mitigating the potential damage from the broader financial market turmoil.

Overall, the most tangible result was that central banks were able to keep short-term market rates close to their policy rates, even during turbulent times. However, this ability was not perfect. In particular, stigma might in some cases have made standing lending facilities less effective than they could have been in preventing spikes in overnight interest rates. Less easy to assess was the success of central banks in addressing funding market pressures, particularly in term unsecured markets. For example, although central bank actions to improve the supply and distribution of term funds and transatlantic cooperation in providing US dollar liquidity both went some way towards alleviating excess demand, they did not manage to eliminate the tensions or prevent them from returning. Indeed, the assessment of success depends crucially on the origins of market tensions: how much came from liquidity concerns, which are amenable to central bank actions, and how much from counterparty risk or other concerns, which are beyond the normal reach of central bank operations. Overall, the judgment was that tensions would have been more acute and more damaging without the forceful interventions of central banks. Finally, central banks' communication about their actions was judged largely successful, especially in distinguishing liquidity management

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[12] Moreover, to counter the upward pressure on the three-month Swiss franc Libor, the SNB had to lower its repo auction rate in order to bring the Libor down to levels in line with the target band's midpoint. The lowering of the repo rate in September came as surprise to market participants. It had a considerable impact on the Libor and thus on the effective stance of Swiss monetary policy.

actions from monetary policy changes. Nonetheless, given that there were still some instances of misunderstanding about the details of central bank operations, there could be room for improvement.

4.1 Keeping short-term money market rates near policy targets

At the outset of the turmoil in early August 2007, some central banks did encounter considerable difficulty in keeping overnight interest rates close to their targets (Graph 2). In the United States, significant injections of reserves to resist firming of rates early in the day sometimes resulted in marked softness in rates at the close of business and on subsequent days in the same maintenance period. In the United Kingdom, by contrast, where the BoE did not expand reserve supply in August, overnight rates, while less volatile, became somewhat elevated. Reflecting the volatile conditions at the time, the fluctuations of market interest rates around central banks' policy rate targets in all major currency areas increased to varying degrees in the first weeks of the turmoil. However, over the following weeks, by adjusting their operating frameworks and/or changing the modalities of their actions within those frameworks, central banks were able to achieve better control of the targeted market rates.

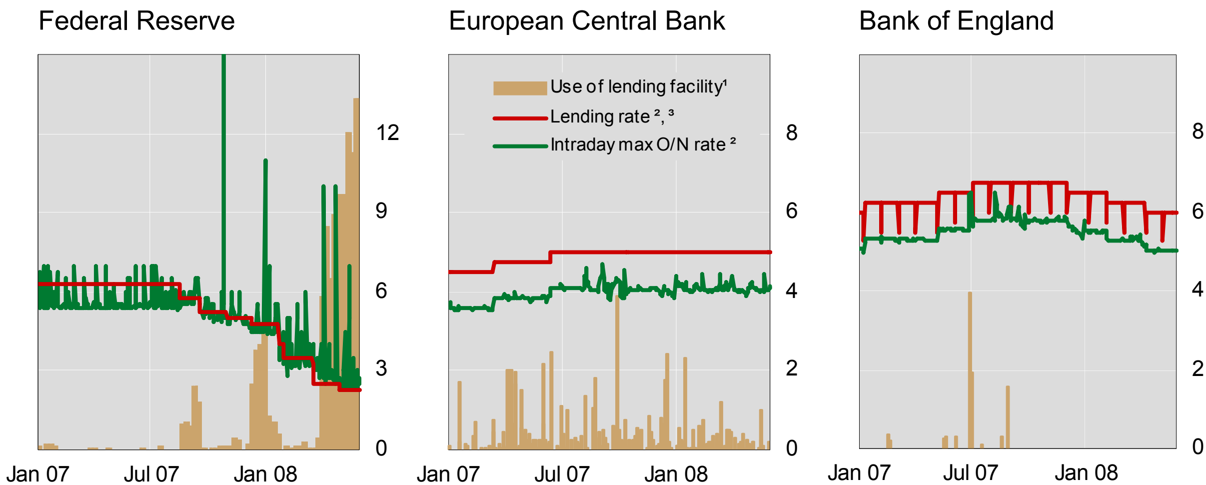
One important observation from this experience is that, even though many central banks have standing lending facilities to serve as a liquidity backstop, these facilities provided in some cases only limited protection against upward pressure on money market rates. Most notably, in the United States, because of stigma, there was limited use of the standing lending facility (discount window), even during some periods in which interbank rates rose above the lending facility rate (Graph 3, left-hand panel). This stigma is in part a legacy of the days when discount window credit was provided at a subsidised rate and involved rationing and scrutiny. Perhaps more importantly, stigma may stem as well from past instances when discount window credit was provided to assist in the resolution of troubled banks. Stigma may also exist because borrowing at a "penalty" rate sends an adverse signal about creditworthiness that adds to the reluctance of banks to use the facility.

In the euro area, by contrast, stigma appears to be less of an issue. During the turmoil, there were no reported interbank trades at rates above the marginal lending facility (MLF) rate, and the facility was used as frequently as in more tranquil times (Graph 3, centre panel). However, it was understood that perceptions of MLFs could change, especially in tense market conditions. In the United Kingdom, as well, there were very few days in which the daily high in interbank rate reported by brokers exceeded the standing facility rate. However, there were anecdotal reports that higher rates had been paid in bilateral deals and that stigma inhibited borrowing from the standing facility, particularly after the provision of emergency liquidity assistance to a mid-sized UK bank in mid-September 2007.

All in all, even though the demand for central bank reserves became less predictable and the reluctance on the part of counterparties to use standing facilities might in some cases have complicated central banks' efforts to keep very short-term market interest rates under control, central banks were largely able to achieve their operational objective of returning market interest rates close to their policy rate targets. In most cases, interest rate volatility declined after the first month or so into the turmoil back to levels comparable to those prevailing before August 2007. Nonetheless, the stability of very short-term rates remained vulnerable and central banks had to maintain a more active attitude in order to contain further episodes of volatility.

Graph 3

Indications of stigma



[1] In billions of local currency units; daily data for the ECB and the Bank of England, weekly averages of daily amounts outstanding for the Federal Reserve [2] In per cent. [3] For the Federal Reserve, primary credit; for the ECB, marginal lending facility; for the Bank of England, lending facility.

Sources: Bank of England; ECB; Federal Reserve; Bloomberg; Datastream.

4.2 Addressing pressures in funding markets

While central banks had tangible success in keeping very short-term interest rates in line with their policy rate targets, it was somewhat more difficult to assess the precise effect of central bank actions in addressing funding market pressures. Regarding term money market tensions, for example, there were on the one hand some instances in which term money market spreads did narrow following central bank announcements or actions (Graph 4). On the other, however, central bank actions were not able to eliminate the tensions and did not prevent tensions from returning subsequently.

This difficulty in assessment has to do with an important question regarding the underlying cause(s) of term money market tensions. If tensions were caused by liquidity concerns, they would in principle be addressable by central bank actions to improve the supply and distribution of liquidity. However, if they were driven by counterparty credit risk concerns, then central bank liquidity operations would be ill positioned to tackle the problem.

Although it was difficult to disentangle the effects of the different causes, central banks assessed that at least some of the impaired willingness or ability of banks to lend term funds – and thus the elevation in term rates – was a result of liquidity concerns (eg uncertainty about funding needs, ability to reliably fulfil such needs at a reasonable price, pressing balance sheet constraints). This assessment of course did not preclude the existence and influence of counterparty risk. However, to the extent that not all of the term spread was believed to be explained by market concerns about counterparty creditworthiness, there was scope for central bank liquidity actions.

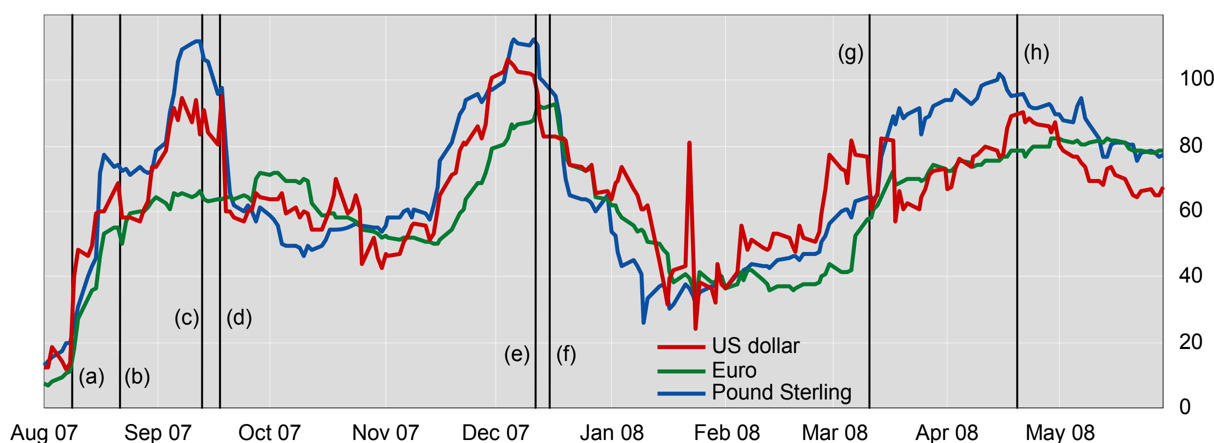
Central banks judged it advisable to pursue a direct reduction in term spreads for two main reasons. First, the shortening of funding maturity was increasing rollover risk, adding to the funding risks that banks were already facing. Second, central banks were concerned about the smooth functioning of the term interbank market, which is a key link in the monetary transmission channel: three-month interbank rates are an important pricing benchmark for a wide range of financial products such as adjustable rate mortgages and commercial loans.

While the rationale for central bank action to counter term money market tensions was established, there was still a question of whether central banks had fully satisfied the relevant demand. In particular, the fact that central bank offers of term funds were in many cases eagerly taken up, resulting in elevated auction stop-out rates, suggests that the operations might have gone only partway towards meeting the underlying funding needs.

Graph 4

Three-month Libor-OIS spread and major central bank actions[1]

In basis points



[1] Three-month Libor minus three-month overnight index swap (OIS) rates. The shaded area is the three-month period during which the contracts span the year-end. The vertical lines indicate (a) 9 August 2007, onset of the turmoil; (b) 22 August, ECB announcement of the first supplementary longer-term refinancing operation; (c) 13 September, BoE supply of additional reserves; (d) 18 September, FOMC 50 basis point rate cut; (e) 12 December, first joint announcement of coordinated central bank actions; (f) 17 December, ECB announcement of an extraordinary two-week tender for its main refinancing operation; (g) 11 March 2008, second joint announcement of coordinated central bank actions; and (h) 21 April, BoE Special Liquidity Scheme announcement.

Source: Bloomberg.

Despite questions about the volume of term fund providing operations, there was some evidence that the modality of operations, especially with respect to the range of eligible collateral, helped alleviate the fallout from the widespread illiquidity in credit markets. Where the option existed, private sector counterparties were in some cases eager to finance their less liquid collateral with the central bank. In the euro area, for example, there was a distinct acceleration towards the use of less liquid collateral in central bank operations. In Canada, term purchase and resale agreements (repo-type transactions) in December 2007 and in the March–April 2008 period were transacted in less liquid collateral than the more usual Government of Canada obligations. In some other jurisdictions, however, the liquidity of collateral appeared to be less of an issue. At the SNB and the RBA, counterparties did not present less liquid collateral than normal. At the BoE, the widened range of eligible collateral for its expanded three-month tenders (starting in December 2007) did not seem to have led to much greater bids than the amount offered. In the United States, the central bank's burden of providing term funds was shared by the Federal Home Loan Banks providing significant amounts of term funds at market rates against a broad range of collateral.

Other measures to underpin the financial sector's access to liquidity also saw positive results. Pressures in collateralised funding markets eased notably following the introduction of the TSLF, though it was difficult to gauge the precise contribution of the facility. The first two offers (late March and early April 2008) met with strong demand. But as market conditions improved, the facility was less fully subscribed. The BoE's Special Liquidity Scheme, designed to improve the liquidity position of the banking system and to foster

market confidence, was also well received by market participants. Data on the total outstanding value of bills lent under the Scheme will be published after the end of the six-month drawdown period.

4.3 Increasing cooperative efforts

In addition to acting locally, central banks also demonstrated their ability to coordinate their operations globally. While central banks have occasionally cooperated in foreign exchange intervention in the past, the cooperation announced in December 2007 was the first joint action conducted in money markets. The cooperation impressed upon market participants both the willingness and the ability of central banks to address the liquidity consequences of the turmoil, even if prompter action might have been desired by some market participants. Making a joint announcement arguably also reduced the risk of the actions being interpreted as a sign of new elevated concerns about the condition of a particular domestic financial system.

Judging by market reaction, the first joint announcement of coordinated actions appeared to have a tangible impact. Prior to the joint announcement, year-end premia had spiked to levels roughly comparable to those observed over the 2000 century date change. By the end of December, premia had subsided notably, even though most central banks had already largely drained the extra reserves they had injected earlier in the month. Term money market spreads then continued to narrow in January (Graph 4). However, market reaction was not as pronounced following the second joint announcement of coordinated actions on 11 March 2008, amid rapidly deteriorating market sentiment. While US dollar term Libor-OIS spreads over the following few days traded narrower than they did before the announcement, the improvement was not lasting. Rate spreads for other major currencies did not show much positive response.

One specific element of coordinated central bank actions was the swap lines between the Federal Reserve, on the one hand, and the ECB and the SNB, on the other, which allowed the two central banks in Europe to provide dollar funds to their counterparties to help ease the time zone frictions buffeting interbank markets over the trading session. While the first round of dollar auctions around the turn of the year was followed by a period of improved liquidity conditions, the resumption of dollar auctions since March 2008 had to contend with more persistent market strains. The continued provision of dollars in Europe was welcomed by market participants and probably helped to prevent a further deterioration in market conditions.[13]

4.4 Communicating clearly

Besides assessing the impact of their actions, central banks also took note of the effect of their communication during the turmoil. Central banks judged that communication about their actions was largely successful, especially in distinguishing liquidity management actions from monetary policy changes. In bilateral discussions with Study Group members, market participants indicated that they generally recognised that actions designed to meet elevated liquidity needs did not signal changes in the stance of monetary policy. The clarity was achieved, in part, by separating most announcements about liquidity operations from those about the policy rate. In general, market participants regarded the innovative operational

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[13] It was observed that the spread between overnight Libor and the effective federal funds rate (an indicator proxying for dollar shortage for European banks) had been smaller (sometimes even negative) on the settlement days of US dollar auctions in Europe. Nonetheless, it is difficult to obtain conclusive evidence that market pressures were indeed eased by the introduction of dollar auctions.

measures adopted during the turmoil as a sign that central banks were determined to maintain control of the money market, rather than as an indication that the situation was worse than had been thought.

Nonetheless, there were still some instances of misunderstanding about the details of policy implementation. For instance, even though novel central bank measures were mostly quickly understood by market participants, there were some cases of transitory confusion about new measures or central bank intentions following policymaker remarks. Similarly, some accounts of central bank actions in the media failed to convey that most injections of reserves would in fact be reversed automatically as the associated reverse operations rolled off. In addition, there was a perhaps overly heavy focus by the media on the size of reserve injections, without sufficient attention to other offsetting operations or to the details of central banks' monetary policy implementation frameworks.[14] These instances of misunderstanding suggest that there is a need to explain central bank actions to the public better.

Some of the communication challenges during the turmoil highlight an important, but unresolved, issue regarding the design of monetary policy implementation frameworks – whether framework features that are useful in emergency situations should also be available in normal times or whether having well documented emergency procedures would suffice. The advantages of having a broad framework that admits different modalities of operations are that it reduces the likelihood that central banks would be constrained by the risk of sending a negative signal when executing out of the ordinary operations, and that the counterparties will be familiar with those less common operations. In the initial weeks of the turmoil, departures from standard operating procedures were in some cases interpreted as overreacting. The risk of sending a negative signal increased when the set of standard procedures that were used in non-stressed circumstances was narrower.[15]

5. Conclusions and recommendations

In the light of central banks' experiences in dealing with the market turmoil, the Study Group has drawn seven conclusions that give rise to corresponding recommendations. The recommendations concern (1) central banks' ability to achieve their policy rate targets in times of turmoil, (2) problems in the domestic distribution of reserves, (3) illiquidity of financial markets or of institutions, (4) problems in the international distribution of liquidity, (5) risks of misinformation and misunderstanding, (6) financial institutions' reluctance to use standing facilities (stigma) and (7) costs associated with central bank interventions, including moral hazard. While these recommendations seem to the Study Group to be advisable, the specific ways that central banks may choose to implement them will depend upon the circumstances and the individual central bank's situation. In any event, the Study Group is aware that the recommendations it identified cannot deal with the root causes and pervasive effects of the market turmoil, which go beyond the sphere of central bank actions.

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[14] For further discussion, see C Borio and W Nelson, "Monetary operations and the financial turmoil" in *BIS Quarterly Review*, March 2008.

[15] An alternative to having a broad framework at all times is to have a relatively narrow framework in normal times but supplemented by a broad range of well documented procedures for use in emergency situations. As noted in Section 4.2, for example, there were some instances in which central banks' decision to accept a broader range of collateral – and thus to allow a change in their portfolio composition – might have helped to alleviate the fallout from illiquid credit markets. These instances suggest that it may be beneficial to have established emergency procedures that can be just pulled "off the shelf" and used only during times of stress.

5.1 Financial turmoil may give rise to two distinct developments that can each make it more difficult for central banks to keep the relevant interest rates near their policy rate targets: first, there may be unpredictable shifts in the aggregate demand for reserves; second, there may be occasions on which a central bank needs to extend large amounts of credit but at the same time keep the net aggregate supply of reserves consistent with its policy rate target. In either case, the operational framework should be capable of achieving the desired policy rate target.

In the opening days of the turmoil, the demand for reserves temporarily rose sharply and became less predictable. To avoid an unwanted tightening of overnight rates, some central banks injected large quantities of reserves, which in some cases led to a soft bias in rates for a short interval after the increased demand subsided but before the additional reserves were removed. In some regions, the increased demand was more long-lived. As a result, in the first few weeks of the turmoil, the fluctuations of overnight market interest rates around central banks' targets increased in the major currency areas. Subsequently, central banks achieved better control of targeted market rates, either by adjusting their frameworks or by changing their tactics within those frameworks. Still, in some regions, rates remained more volatile than usual.

The temporary departures of short-term interest rates from targeted levels had the potential to trigger confusion about central banks' monetary policy – as distinct from liquidity provision – intentions. In addition, the higher interest rate volatility might have increased uncertainty about future overnight rates, putting additional upward pressure on the already elevated term premiums. However, the costs of volatility in the overnight rate should not be overstated as this volatility does not necessarily get transmitted to longer-term rates or have macroeconomic consequences. Indeed, tensions in term money markets appear to have arisen from quite different causes.

In general, the measures necessary to maintain tighter control over overnight rates in periods of market turbulence will require the central bank to support the interbank market, or even replace it in extreme cases, to a greater extent than desirable in normal times.[16] For example, central banks could increase the frequency of their operations to as much as several times a day. Central banks could also exploit the automatic stabilising property of deposit and loan facilities that establish a corridor around the main policy rate, by narrowing that corridor in turbulent periods. (As discussed in conclusion 5.6, however, this approach requires that the willingness of institutions to use a central bank's standing loan facility not be inhibited by stigma.) A similar result can be accomplished by standing ready to transact directly in the interbank or repo market. In the same vein, stability in short-term rates can be achieved by remunerating at the policy rate deposits at the central bank in a wide band around required or target levels.

Over the course of the turmoil, central banks also extended large amounts of credit to alleviate pressures caused by malfunctioning markets and to assist in the resolution of specific troubled institutions. Those extensions of credit that were necessitated for reasons other than to satisfy the aggregate demand for central bank reserves had to be offset in order to keep the net supply of reserves unchanged and thereby keep short-term interest rates in line with the policy rate targets. So far during the turmoil, central banks have been successful in conducting offsetting reserve draining operations. However, it is conceivable that, in some future circumstances, the necessary extensions of credit could be so large that they would be difficult to offset with existing instruments. There are a number of ways to prepare for

[16] Normally, allowing interbank markets to distribute reserves has the benefit of encouraging banks to manage their own liquidity and making them test their names by seeking to borrow from peers.

potentially massive reserve-draining operations: maintaining a sufficiently large stock of short-term repurchase agreements that can be run down; holding securities that can be redeemed for cash, quickly repoed out or sold outright; or having the ability to offer remunerated deposits or issue interest-bearing central bank securities.

5.2 Impaired functioning of the interbank money market can result in a poor distribution of central bank reserves, which can exacerbate tensions in money markets beyond the aggregate disturbances identified in conclusion 5.1. In order to distribute reserves effectively when the interbank market is impaired, central banks should be capable of conducting operations with an extensive set of counterparties and against a broad range of collateral.

During the turmoil, the functioning of the interbank market for central bank reserves was in some cases severely impaired. The resulting maldistribution of reserves further complicated central bank efforts to control the targeted interest rates. In those instances, it was advantageous for central banks to transact with a broad range of counterparties to be able to provide reserves directly to those unable to secure funds on the interbank market. Moreover, since those institutions had typically already exhausted their most liquid securities to acquire funds in the secured market, it was useful for the central bank to extend credit against a wide range of collateral.

Flexibility in operational frameworks was needed to respond to the turmoil and will most likely be needed to respond to future analogous episodes. Central banks should either be prepared to transact, as a normal course of business, with a diverse set of counterparties and accept a broad range of collateral, or be able to adjust quickly in stressed situations their collateral and counterparty lists within published guidelines. Making adjustments outside a published framework may take longer to implement, require more communication to explain the purpose and nature of the adjustments and entail more operational risk.

However, both alternatives – be it a broad set of tools used in both normal and emergency times, or a well documented set of emergency procedures that includes a broad range of tools – have to reckon with the inability to foresee the nature of future crises. This limitation suggests that at least some innovations to operations will probably be needed to deal with unanticipated financial market developments.

In most cases, markets responded positively to initiatives by central banks to adjust their operations to address tensions brought about by the market turmoil. In the light of that experience, those central banks that opt to have emergency procedures that are usually held in reserve should be ready to invoke them in a timely fashion when needed so as to avoid or mitigate further financial instability resulting from delays. Still, central banks would have to consider the potential costs, including moral hazard, associated with adjusting frameworks or contingency plans (see conclusion 5.7).

5.3 In a period of financial turmoil, illiquid conditions may pose a grave threat to the effective transmission of monetary policy and to financial stability. In such circumstances, central banks should be prepared to expand their intermediation activities and, if needed, take steps that go beyond adjusting the aggregate supply or distribution of reserves.

When the performance of key financial markets deteriorates, it may be necessary for central banks to expand their intermediation or take other innovative steps to support these markets. For example, in response to the near gridlock in the term interbank money market during the turmoil, central banks increased the volumes and maturities of their provision of term funds. When the liquidity in many secured funding markets evaporated, central banks helped financial institutions finance their holdings of what had suddenly become highly illiquid assets by adding some of these affected assets to their lists of eligible collateral, or by establishing

securities swap facilities under which financial institutions could borrow liquid assets from the central banks' portfolio in exchange for less liquid ones. A similar alternative would be for a central bank to borrow securities from the government or create its own bills and swap them for less liquid assets. In those cases where collateral frameworks were already sufficiently broad, counterparties could substitute illiquid for liquid assets readily within the existing framework.

5.4 Global channels for distributing liquidity across borders may become impaired in times of financial turmoil. To prepare for that possibility, central banks should take steps to strengthen their capacity to counter problems in the international distribution of liquidity. Possible steps include establishing or maintaining standing swap lines among themselves and accepting – or developing and maintaining the ability to accept – foreign currency denominated assets or obligations booked abroad as collateral in their operations.

During periods of financial market turmoil, global channels for distributing liquidity may face significant impediments. In such situations, coordination between central banks may be useful to provide funds in a foreign currency to internationally active banks, which may otherwise be unable to find adequate supply in the market. For example, as discussed in Section 2, in the first few months of the turmoil, European banks' desire to secure US dollar funds early in the US trading session led to large swings over the day in the demand for dollar interbank funds, complicating the Fed's monetary policy implementation. The swap lines established between the Federal Reserve, on the one hand, and the ECB and SNB, on the other, enabled the latter two central banks to provide dollar funds to their counterparties during European trading hours. This, in turn, reduced to some extent the pressure on the market for US dollar funds.

Internationally active banks should enhance their ability to access the facilities of the central banks providing liquidity in the currencies they may need. Such improved access would allow them to acquire needed funds when market channels are impaired. Central banks, for their part, may want to consider granting access to their facilities to financial institutions outside their respective jurisdictions.

In addition, central banks should take a number of steps to strengthen their capacity to ease bottlenecks in the international distribution of liquidity, should the necessity arise. Improving frameworks for prompt information exchange among relevant staffs and principals across central banks is an essential starting point to enhancing coordination more broadly. Going forward, the major central banks should either maintain standing swap lines or preserve the ability to establish them at short notice. Such swap lines allow the lending decision to rest with the home central bank, which should possess the most accurate information on the borrowing bank's financial condition.

Another option to allow banks to mobilise liquidity across borders is to supply liquidity against collateral denominated in foreign currencies and/or held in offshore locations, which could be done regularly or only in extraordinary situations. In order to facilitate the cross-border use of collateral, central banks should evaluate the scope for infrastructure or procedural improvements that would allow collateral to be transferred between custodians, countries and central banks quickly and at low cost. In part to aid central banks in their consideration of these issues, the Committee on Payment and Settlement Systems (CPSS) is at the time of writing updating and supplementing its 2006 report on cross-border collateral practices.[17]

[17] CPSS working group report, *Cross-border collateral arrangements*, January 2006.

Further down the road, while bearing in mind that the scope of central bank open market operations in some countries is significantly constrained by statute, one possibility that the major central banks may wish to consider is conducting open market operations against a common list of high-quality government obligations denominated in a range of global currencies. Any initiative for reviewing and enhancing coordination among central bank operations needs, however, to consider carefully the macro- and microprudential implications for both home and host central banks.

5.5 Misinformation and misinterpretation of central bank actions are more likely and costly in times of stress. During such periods, central banks should enhance their communication with market participants and the media.

In periods of financial turbulence, market and media attention may be intensely focused on central banks' operations and their apparent implications, while market participants may be unusually skittish. All this can cause markets to react sharply to incoming information – and misinformation – about central bank actions. For example, unusual central bank operations may be perceived as either constituting or presaging a change in the stance of monetary policy, even though the real intention of such operations may be only to maintain the prevailing stance of monetary policy. Unusual central bank actions may also be perceived as indicating that the situation is worsening, exacerbating market participants' fears about financial market conditions, the health of individual institutions or the economic outlook. Thus, the consequences of misinterpretation of central bank action can be substantial. Cross-country differences in central bank operational frameworks can also add to the risk of the public misunderstanding central bank actions.

In general, however, these risks can be mitigated by means of careful communication. Moreover, the potential for misinterpretation is not a compelling reason to avoid central bank action that otherwise would be warranted. Indeed, the effect of exceptional central bank operations during the turmoil is likely to have been enhanced by the positive interpretations by market participants that central banks were ready and willing to act, in addition to their impact on actual funding opportunities.

In addition to communications about unusual operations, it may be helpful in turbulent times for central banks to provide information more broadly about factors expected to influence upcoming open market operations, so as to help reduce market participants' uncertainty over the availability of funds and in turn any tendency to hoard liquidity early in the day or early in the maintenance period. The effectiveness of information provision in stressed conditions may be enhanced by providing information also in normal times about expected aggregate required reserves and autonomous factors. This may familiarise market participants with the properties of the information, help them make better judgments about the availability of funding and make them less likely to misinterpret central bank actions. Care should be exercised with information provision, however, to avoid inadvertently aggravating the stigma associated with the use of standing facilities (see conclusion 5.6).

Apart from enhancing the information they provide in stressed situations, central banks, in conjunction with prudential authorities where appropriate, may also need to increase the amount of information they collect from market participants. Monitoring the liquidity situation can help better calibrate the size, timing and term of open market operations. In addition, direct feedback from market participants can help central banks get a clearer picture of money market conditions and respond to incipient problems more quickly.

5.6 In stressed situations, the stigma associated with standing lending facilities may become acute, thereby reducing their efficacy as backup sources of funding. Central banks should continue their efforts to reduce stigma by, for example, enhancing the understanding of the role of such facilities and

designing new facilities that are less associated with past instances of emergency assistance.

A standing lending facility is a widely adopted central bank instrument for providing liquidity insurance against frictional problems in payment systems and overnight money markets. However, in the United States and, to a lesser extent, in some other currency areas, the effectiveness of this instrument has been limited by banks' unwillingness to use it. In particular, because of stigma, there was relatively little use of standing lending facilities, even on some days when interbank rates rose well above the interest rates on the facilities.

Stigma can sometimes exist in normal times but tends to increase in stressed times. While stigma is most often associated with lending related to emergency liquidity assistance, it can also affect lending for more benign purposes, such as when there is a frictional problem in the payment system or the money markets, particularly when financial turmoil raises doubts about the soundness of financial institutions. If anonymity is not well preserved, or if senior bank management and bank regulators are not completely familiar with the more benign purposes of standing loan facilities, then there is a greater risk that borrowing from standing facilities would be regarded as a sign of borrower weakness. When this occurs, the effectiveness of these facilities as a liquidity backstop is severely impaired.

Central banks should therefore consider whether mechanisms that are less prone to stigma could be designed for meeting liquidity needs. One possibility is to establish clearly separate facilities for providing loans only for addressing payments-related frictions or a broad-based tightness in overnight interbank markets.

Nonetheless, further efforts to reduce stigma may yet be needed. For example, although the BoE and, to a lesser extent, the Federal Reserve already have facilities that are intended primarily for frictional borrowing, the usage of these facilities is still somewhat affected by stigma. In such cases, there may be scope for central banks to emphasise further to senior bank staff and bank regulators that borrowing is not at all discouraged, including for the purpose of relending the proceeds. At the same time, banks and regulators can help reduce uncertainty or misinformation about the health of the financial sector by expediting disclosure of relevant information. Further steps could also be taken to ensure anonymity of standing facility use or, if anonymity is already ensured, to reassure banks that borrowing is indeed anonymous. However, experience indicates that, once established, stigma is difficult to dispel.

5.7 The expectation that central banks will act to attenuate market malfunctioning may create moral hazard by weakening market participants' incentives to manage liquidity prudently. Central banks should carefully weigh the expected benefits of actions to re-establish liquidity against their potential costs and, where necessary, introduce or support safeguards against the distortion of incentives.

Central banks have demonstrated that they will take extraordinary actions to deal effectively with market turmoil when sufficient risks to financial stability and to the effective transmission of monetary policy exist. Decisions to take similar actions require sufficient confidence in the likely effectiveness of central bank actions and a determination that the anticipated costs, including those associated with moral hazard, are not too high.

For example, during the turmoil, central banks elected to take steps to address the disruption in term money markets because those markets played a key role in funding the banking system and in the monetary transmission mechanism. Central banks judged that a significant component of the disruption was due to heightened liquidity risks, which were amenable to central bank market operations, as opposed to increased credit risks, which were not.

Awareness that central banks will intervene necessarily affects the incentives of market participants and, consequently, their behaviour, at least to some extent. It is possible that

they will either assume more liquidity risk or weaken their own liquidity management efforts, thus making the need for central bank interventions more likely and/or their costs higher. Insofar as central bank actions might lead to a degradation of market participants' management of liquidity and other risks, a possible offset would be to implement tighter supervisory and prudential policies concerning the management of liquidity and related risks.[18]

Central banks' interventions during the turmoil to encourage the smooth functioning of term money markets could also engender the view that yet other markets will be an appropriate target of central bank operations in very stressed conditions, further increasing moral hazard. To help limit the risk of such mission creep and mitigate moral hazard, central banks may wish to clarify their objectives and principles for dealing with financial market disruptions.

[18] The Basel Committee on Banking Supervision plans to issue by July 2008 for public comment strengthened industry and supervisory sound practice standards for liquidity risk. The standards will address inter alia stress testing, contingency funding plans and the management of off-balance sheet exposures.

Annex 1
Detailed chronology of selected central bank actions

Date	Central bank	Type of action	Description
2007			
9 August	SNB	Reserve management operation	Conducted an overnight fine-tuning operation to provide the market with additional funds of CHF 1.4 billion, immediately after tension had arisen.
	ECB	Communication	Released a statement that it was "… closely monitoring markets and stands ready to act to assure orderly conditions in the euro money market".
		Reserve management operation	Conducted an overnight fine-tuning operation for EUR 95 billion. Met all demand at its policy rate of 4% (instead of conducting its more usual variable rate tender). This tender specification allowed the ECB to inject an amount of liquidity matching counterparties' demand, which the ECB could not quantify by means of its regular liquidity analysis.
	BoC	Communication	Released a statement that it "… would like to assure financial market participants and the public that it will provide liquidity to support the stability of the Canadian financial system and the continued functioning of financial markets".
		Reserve management operation	Executed three special purchase and resale agreements (SPRA) over the course of the day totalling CAD 1.64 billion, leaving settlement balances at CAD 1.8 billion.
10 August	RBA	Reserve management operation	Conducted regular operations that were larger than normal.
	BoJ	Reserve management operation	Injected T+0 (same-day start) overnight funds equal to JPY 1 trillion in the morning and T+1 (next-day start) one-week funds equal to JPY 600 billion in the afternoon.
10 August	SNB	Reserve management operation	Conducted, in addition to its regular operation, an overnight auction to inject CHF 1.7 billion.

10 August (cont.)	ECB	Communication	Communicated that it "continues to closely monitor the conditions in the euro money market".
		Reserve management operation	Conducted an overnight fine-tuning operation for EUR 61 billion.
	BoC	Reserve management operation	Executed three SPRAs totalling CAD 1.685 billion and leaving settlement balances at CAD 1.6 billion.
	Fed	Communication	Released a statement that it "…is providing liquidity to facilitate the orderly functioning of financial markets [and] will provide reserves as necessary through reserve management operations to promote trading in the federal funds market at rates close to the Federal Open Market Committee's target of 5¼%."
		Reserve management operation	Conducted an extraordinary three auctions of overnight repurchase agreements totalling USD 38 billion, with the final auction occurring in the early afternoon, well after its normal operating time. The quantity provided far exceeded banks' remaining need to accumulate reserves to meet reserve requirements for the maintenance period under way.
13 August	BoJ	Reserve management operation	Provided T+0 one-week funds equal to JPY 600 billion.
	ECB	Reserve management operation	Conducted an overnight fine-tuning operation for EUR 48 billion.
	BoE	Communication	Posted a screen announcement reminding counterparties that standing facilities have been, and continue to be, available every day throughout the day.

14 August	SNB	Collateral	Announced that it would accept a wider range of collateral for its daily repo auctions, but the move was not related to the turmoil in money markets.
	ECB	Reserve management operation	Conducted an overnight fine-tuning operation for EUR 8 billion.
15 August	BoC	Collateral	Temporarily expanded its list of eligible securities for intraday liquidity operations to include collateral that is accepted for the Bank's standing liquidity facility, which includes CP but not ABCP.
16 August	BoC	Communication	Released a press statement welcoming market-based framework for addressing the problems facing non-bank ABCP.
17 August	Fed	Communication	The FOMC announced in an intermeeting statement that downside risks to growth had increased appreciably.
		Modification to standing loan facility terms	Reduced the spread between the primary credit facility rate and the federal funds target rate from 100 to 50 basis points, and increased the allowable term on loans from overnight to 30 days. The changes were intended to provide depositories with greater assurance about the cost and availability of funding.
22 August	RBA	Reserve management operation	Conducted regular operations involving a significantly larger net injection of funds and markedly longer term than normal.
23 August	ECB	Longer-term operation	Conducted a supplementary long-term refinancing operation (LTRO) with three-month maturity for EUR 40 billion.
26 August	Fed	Communication / collateral	Reminded banks that it did accept ABCP, and clarified that it would accept paper for which the pledging bank was providing liquidity or credit support.
5 September	ECB	Communication	"Volatility in the euro money market has increased and the ECB is closely monitoring the situation. Should this persist tomorrow, the ECB stands ready to contribute to orderly conditions in the euro money market".

5 September (cont.)	BoE	Other	Announced that reserves banks raised their aggregate reserves targets by 6% for the September maintenance period, and that it would offer additional reserves if secured overnight rates continued to exceed Bank Rate by an unusual amount.
6 September	RBA	Communication / collateral	Announced that its list of collateral acceptable for repo would be expanded beginning on 17 September to include additional bank-issued liabilities and on 8 October to include AAA RMBS and P-1 residential mortgage-backed commercial paper.
	BoC	Communication / collateral	Indicated that it was committed to providing liquidity and that effective 7 September it would restore standard terms for SPRAs.
12 September	ECB	Longer-term operation	Conducted a supplementary long-term refinancing operation (LTRO) with three-month maturity for EUR 75 billion.
13 September	SNB	Reserve management operation	Starting on this date, punctually absorbed liquidity directly in the interbank market, whenever interbank overnight repo rates dropped 25 basis points below the SNB's auction rate.
		Longer-term operation	Conducted its first ever three-month repurchase transaction for CHF 5 billion.
	BoE	Reserve management operation	As the secured overnight rates had continued to exceed the policy rate by more than usual, the BoE supplied additional reserves equivalent to 25% of the aggregate target. To accommodate this additional supply, the range around banks' reserves targets within which reserves holdings are remunerated was widened from ±1% to ±37.5%.
18 September	BoE	Reserve management operation	Supplied additional reserves equivalent to a further 25% of the aggregate reserves target via an exceptional two-day repo open market operation (OMO). The ranges around reserves targets remained unchanged at ±37.5%.

19 September	BoE	Communication / collateral / counterparties	Announced plans to conduct four three-month term auctions against a much wider range of collateral than is eligible in the weekly OMOs (and to a wider set of counterparties). Bids were to be submitted as a spread (minimum 100 basis points) over Bank Rate prevailing over the term of the auctions. In the period between the announcement and the date of the first auction, market rates fell substantially, such that obtaining funds in the auction became expensive relative to prevailing market rates. No bids were received in any of the auctions.
20 September	BoE	Reserve management operations	The additional 25% of reserves first offered in the previous weekly OMO were reoffered, as were the additional 25% of reserves offered at the unscheduled fine-tuning OMO. That meant additional reserves equivalent to 50% of the aggregate target were offered. Accordingly, the range around reserves targets were widened to ±60%.
27 September	BoE	Reserve management operation	The additional 25% of reserves first offered in the previous weekly OMO were again reoffered. But the additional 25% of reserves offered at the unscheduled fine-tuning OMO were not reoffered. Ranges were maintained at ±60%.
28 September	BoJ	Reserve management operation	Injected T+0 overnight funds equal to JPY 1.6 trillion on the semi-fiscal year-end.
End-September–mid-October	BoC	Reserve management operations	Daily SPRAs and elevated settlement balance levels reflecting pressure on overnight rate.
3 October	BoE	Other	Announced that reserves banks raised their aggregate reserves targets by a further 13% for the October maintenance period. Ranges around reserves targets were set at ±30%.
	BoJ	Longer-term operations	Began operations that extended over year-end, earlier than in 2006.
8 October	ECB	Communication	Announced its new liquidity management policy.

12 October	ECB	Reserve management operation	Conducted a liquidity fine-tuning operation (the first of this kind in line with its communication on 8 October). It absorbed EUR 30 billion with a five-day maturity (until the subsequent regular main refinancing operation (MRO)).
7 November	BoE	Other	Announced that reserves banks had raised their aggregate reserves targets by a further 6% for the November maintenance period. Ranges around reserves targets were set at ±30%.
8 November	ECB	Communication	Announced that it would renew the two supplementary three-month LTROs of August and September.
22 November	ECB	Longer-term operation	Renewed the first supplementary LTRO for an amount of EUR 60 billion as announced on 8 November.
23 November	ECB	Communication	"The ECB has noted re-emerging tensions in the euro money market. To counter the re-emerging risk of volatility, the ECB intends to reinforce […] its policy of allocating more liquidity than the benchmark amount in main refinancing operations […]."
26 November	Fed	Communication	Announced it planned to conduct a series of term repurchase agreements that would extend into the new year in response to heightened pressures in money markets for funding through the year-end. Also said it planned to provide sufficient reserves to resist upward pressures on the federal funds rate above the FOMC's target rate around year-end.
28 November	Fed	Longer-term operation	Conducted a 43-day repo auction to supply USD 8 billion (as announced on 26 Nov).
29 November	BoE	Communication	Announced it would offer GBP 10 billion of reserves via a five-week repo OMO to alleviate concerns that market conditions would be particularly tight over the year-end.

30 November	ECB	Communication	Announced its year-end liquidity management policy, including the lengthening of its main refinancing operation settling on 19 December to two weeks (from one week).
3 December	SNB	Communication / longer-term operation	Announced and conducted a repo with one-month maturity for CHF 4 billion to cover needs over year-end.
5 December	BoE	Other	Announced that reserves banks had raised their aggregate reserves targets by a further 7% for the December maintenance period. This meant that banks' chosen aggregate target had increased by 37% since the August maintenance period. Ranges around reserves targets were set at ±30%.
6 December	BoE	Longer-term operation	Offered GBP 10 billion of reserves via a five-week repo OMO to alleviate concerns that market conditions would be particularly tight over the year-end.
11 December	ECB	Longer-term operation	Renewed the second supplementary LTRO for an amount of EUR 60 billion as announced on 8 November.

12 December	BoC, BoE, ECB, Fed, SNB, BoJ, Riksbank	Communication	Jointly announced several coordinated measures designed to make turn-of-the-year funding available directly to a larger number of financial institutions and against a broader set of eligible collateral. Fed: Introduced a Term Auction Facility (TAF) to provide term loans to depository institutions against the wide range of collateral already accepted at the discount window; announced first four auction dates. Established swap lines between the Federal Reserve, on the one hand, and the ECB (USD 20 billion) and the SNB (USD 4 billion), on the other. ECB: Announced two US dollar liquidity-providing operations, in connection with the TAF, against ECB-eligible collateral for a maturity of 28 and 35 days; to take place on 17 and 20 December. SNB: Announced a 28-day US dollar repo auction (for up to USD 4 billion) against SNB-eligible collateral, to take place on 17 December. BoE: Expanded the amount of three-month funds to be offered at the scheduled long-term OMOs in December and January to GBP 10billion; widened the range of high-quality collateral accepted for funds advanced at the three-month maturity. BoC: Announced plans to enter into term purchase and resale agreements (term PRA) extending over the year-end; temporarily expanded the range of securities eligible for these transactions. BoJ and Riksbank: Did not announce additional operations but welcomed the measures taken by the other central banks.

12 December (cont.)	BoC	Communication	Announced its intention to broaden the collateral accepted for the Standing Lending Facility to include ABCP (by end-March 2008) and US Treasuries (expected by mid-2008). Consultation with market participants on the eligibility criteria for ABCP to take place in the next two months.
13 December	SNB	Longer-term operation	Conducted a repo with one-month maturity for CHF 6.7 billion to cover needs over year-end.
	BoC	Longer-term operation	Conducted the first term PRA operation (CAD 2 billion to mature on 10 January).
14 December	SNB	Longer-term operation	Conducted a repo with three-week maturity for CHF 3.8 billion to cover needs over year-end.
17 December	SNB	Longer-term operation	Conducted a repo with three-week maturity for CHF 2 billion to cover needs over year-end.
		Longer-term operation	Conducted USD repo auction for USD 4 billion in one-month funds with settlement on 20 December.
	ECB	Reserve management operations	Conducted a liquidity absorbing fine-tuning operation (FT) for an amount of EUR 36.6 billion. From 17 December until 3 January, it would conduct nine liquidity absorbing FTs. It would also conduct a liquidity absorbing FT on the last day of the maintenance period, 15 January 2008.
		Longer-term operation	Conducted TAF auction for USD 10 billion in one-month funds.
		Communication	Clarified the specification of the exceptional two-week MRO to be allotted on the following day: as a minimum it would satisfy all bids at and above the weighted average rate of the MRO settled the previous week, ie 4.21%.
	Fed	Longer-term operation	Conducted TAF auction for USD 20 billion in one-month funds with settlement on 20 December.
18 December	ECB	Reserve management operation	Provided EUR 350 billion in a two-week reverse operation (EUR 168 billion above the so-called benchmark amount).

18 December (cont.)	BoE	Longer-term operation / collateral	Conducted the first extended three-month repo OMO for GBP 10 billion against a wider range of high-quality collateral.
	BoC	Longer-term operation	Conducted the second term PRA operation (CAD 2 billion to mature on 4 January).
20 December	ECB	Longer-term operation	Conducted TAF auction for USD 10 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction for USD 20 billion in one-month funds with settlement on 27 December.
21 December	Fed	Communication	Announced its intention to conduct biweekly TAF auctions for as long as necessary to address elevated pressures in short-term funding markets.
28 December	BoJ	Reserve management operation	Injected T+0 overnight funds equal to JPY 800 billion on the year-end.
2008			
4 January	Fed	Communication	Announced its intention to conduct two USD 30 billion TAF auctions in January.
9 January	BoE	Other	Announced that reserves banks had reduced their aggregate reserves targets by 8% for the January maintenance period. Ranges around reserves targets remained at ±30%.
10 January	SNB	Communication	Announced intention to conduct a USD repo auction of maximum USD 4 billion, on 14 January.
	ECB	Communication	Announced intention to conduct two TAF auctions of USD 10 billion each, on 14 and 28 January.
14 January	SNB	Longer-term operation	Conducted USD repo auction for USD 4 billion in one-month funds with settlement on 17 January.

14 January (cont.)	ECB	Communication	Communicated ahead of the February maintenance period that it “will, for as long as needed, allocate more liquidity than the benchmark amount in main refinancing operations to accommodate the demand of counterparties to fulfil reserve requirements early within the maintenance period”.
		Longer-term operation	Conducted TAF auction for USD 10 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction for USD 30 billion in one-month funds with settlement on 17 January.
15 January	BoE	Longer-term operation	Conducted the second extended three-month repo OMO for GBP 10 billion against a wider range of high-quality collateral.
17 January	BoJ	Longer-term operations	Began operations that extended over fiscal year-end, earlier than in 2007.
28 January	ECB	Longer-term operation	Conducted TAF auction for USD 10 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction for USD 30 billion in one-month funds with settlement on 31 January.
1 February	Fed	Communication	Announced its intention to conduct two USD 30 billion TAF auctions in February, maintaining the auction sizes at the January level.
	ECB	Communication	Announced its decision not to participate in TAF loan auctions with the Fed in February, citing significantly improved dollar liquidity in Europe.
4 February	SNB	Communication	Communicated that it would not renew its US dollar auction maturing on 14 February.
6 February	BoE	Other	Announced that reserves banks increased their aggregate reserves targets by 1% for the February maintenance period. Ranges around reserves targets remained at ±30%.
7 February	ECB	Communication	Announced its decision to renew the two supplementary three-month LTROs of November and December.
11 February	Fed	Longer-term operation	Conducted TAF auction to supply USD 30 billion in one-month funds.

20 February	ECB	Longer-term operation	Renewed the November supplementary LTRO at the same size of EUR 60 billion (as announced on 7 February).
25 February	Fed	Longer-term operation	Conducted TAF auction to supply USD 30 billion in one-month funds.
29 February	Fed	Communication	Announced intention to conduct two TAF auctions of USD 30 billion each, on 10 and 24 March.
5 March	BoE	Other	Announced that reserves banks had decreased their aggregate reserves targets by 5% for the March maintenance period. Ranges around reserves targets remained at ±30%.
7 March	Fed	Communication	Announced an increase in the size of March TAF auctions to USD 50 billion each.
			Announced it was in close consultation with foreign central bank counterparts concerning liquidity conditions in markets.
		Longer-term operation	Initiated a series of 28-day term repo auctions (expected total of USD 100 billion). In this “Single-Tranche OMO Program”, primary dealers may elect to deliver as collateral any of the types of securities eligible as collateral in conventional OMOs.
10 March	Fed	Longer-term operation	Conducted TAF auction to supply USD 50 billion in one-month funds.

11 March	BoC, BoE, ECB, Fed, SNB, BoJ, Riksbank	Communication	Jointly announced specific measures to address liquidity pressures. Fed: Introduced a Term Securities Lending Facility (TSLF) to lend up to USD 200 billion of Treasury securities to primary dealers, against a pledge of other securities, for a term of 28 days. Increased the Fed's existing temporary swap line with the ECB to USD 30 billion and that with the SNB to USD 6 billion. Extended the swap lines' term to 30 September 2008. ECB: Announced a TAF operation of up to USD 15 billion at 28-day maturity, to be conducted on 25 March. SNB: Announced a US dollar repo auction of up to USD 6 billion at 28-day maturity, to be conducted on 25 March. BoC: Announced two term PRA operations to be conducted on 20 March and 3 April. BoE: Announced continuation of its expanded three-month repo OMO against a wider range of collateral, to be offered at the scheduled operations on 18 March and 15 April. A minimum bid rate was introduced, based on the three-month OIS swap rate. BoJ and Riksbank: Did not announce additional operations, but welcomed the measures taken by the other central banks.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 15 billion in 28-day funds.
12 March	ECB	Longer-term operation	Renewed the December supplementary LTRO at the same size of EUR 60 billion (as announced on 7 February).
14 March	SNB	Longer-term operation	Conducted a three-month repo auction to supply CHF 4 billion.

14 March (cont.)	Fed	Communication / other	"… is monitoring market developments closely and will continue to provide liquidity as necessary to promote the orderly functioning of the financial system." The Board voted unanimously to approve the arrangement announced by JPMorgan Chase and Bear Stearns.
16 March (Sunday)	Fed	Communication	Announced the introduction of a Primary Dealer Credit Facility (PDCF), which allows primary dealers access to overnight discount window loans. The facility would be in operation for at least six months.
		Modification to standing loan facility terms	Lowered the primary credit rate to 25 basis points (from 50 basis points) above policy rate; increased the maximum allowable loan term to 90 days (from 30 days).
17 March	BoE	Reserve management operation	Conducted an exceptional fine-tuning OMO to supply an extra GBP 5 billion (25% of reserves target) in a three-day repo.
18 March	BoE	Longer-term operation / collateral	Conducted the third expanded three-month repo OMO for GBP 10 billion against a wider range of high-quality collateral.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 15 billion in 28-day funds.
20 March	ECB	Reserve management operation	Conducted a fine-tuning operation to provide EUR 15 billion ahead of the long holiday weekend in Europe.
	BoE	Communication / reserve management operation	Announced reoffering of the extra GBP 5 billion (offered on 17 March) in the weekly OMO of 20 March and in weekly OMOs over the rest of the current maintenance period.
	BoC	Longer-term operation	Conducted term PRA operation to supply CAD 2 billion in one-month funds (to mature on 17 April).
	Fed	Communication	Announced modifications to the terms and conditions for the new TSLF (to allow acceptance of a broader range of collateral than previously announced); provided details for the first auction on 27 March.
24 March	Fed	Longer-term operation	Conducted TAF auction to supply USD 50 billion in one-month funds.

25 March	SNB	Longer-term operation	Conducted USD repo auction to supply USD 6 billion in one-month funds.
	ECB	Longer-term operation	Conducted TAF auction to supply USD 15 billion in one-month funds.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 15 billion in 28-day funds.
27 March	SNB	Longer-term operation	Conducted a three-month repo auction to supply CHF 5 billion.
	Fed	Other	Conducted the first weekly TSLF auction with offering amount USD 75 billion (against Schedule 2 collateral).
28 March	ECB	Communication	Announced its decision to conduct two EUR 25 billion supplementary six-month LTROs (2 April and 9 July) and further supplementary three-month LTROs of EUR 50 billion each (21 May and 11 June).
	Fed	Communication	Announced its intention to conduct two TAF auctions of USD 50 billion each, on 7 and 21 April.
31 March	BoJ	Reserve management operation	Injected T+0 overnight funds equal to JPY 3 trillion on the fiscal year-end.
	SNB	Longer-term operations	Conducted a three-month repo auction to supply CHF 4 billion.
	ECB	Reserve management operation	Conducted a fine-tuning operation to provide EUR 15 billion in overnight funds.
	BoC	Collateral	Announced the eligibility criteria for accepting ABCP as collateral for the standing liquidity facility.
2 April	ECB	Longer-term operation	Conducted the first supplementary six-month LTRO to supply EUR 25 billion.
3 April	BoC	Longer-term operation	Conducted term PRA operation to supply CAD 2 billion in one-month funds (to mature on 1 May).
	Fed	Other	Conducted the second TSLF auction with offering amount USD 25 billion (against Schedule 1 collateral).
4 April	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 15 billion in 23-day funds.

7 April	ECB	Longer-term operation	Conducted TAF auction to supply USD 15 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction to supply USD 50 billion in one-month funds.
9 April	BoE	Other	Announced that reserves banks had raised their aggregate reserves targets by 18% for the April maintenance period. Ranges around reserves targets remained at ±30%.
10 April	Fed	Other	Conducted third TSLF auction with offering amount USD 50 billion (against Schedule 2 collateral).
15 April	BoJ	Longer-term operations	Began operations that extended over quarter-end, earlier than in 2007.
	BoE	Longer-term operation / collateral	Conducted the fourth expanded three-month OMO against a wider range of collateral, for an increased amount of GBP 15 billion.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
17 April	BoC	Longer-term operation	Conducted term PRA transaction to supply CAD 2 billion of 28-day funds (to mature on 15 May).
	Fed	Other	Conducted fourth TSLF auction with offering amount USD 25 billion (against Schedule 1 collateral).
18 and 21 April	RBA	Longer-term operation	Conducted repos with maturities of up to one year against collateral that includes RMBS.
18 April	SNB	Communication	Announced that it would renew its USD repo auction maturing on 24 April.
21 April	ECB	Longer-term operation	Conducted TAF auction to supply USD 15 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction to supply USD 50 billion in one-month funds.
	BoE	Other	Launched a Special Liquidity Scheme in which banks can swap high-quality but temporarily illiquid assets for treasury bills for a term of one year (renewable to up to three years).
22 April	SNB	Longer-term operation	Conducted USD repo auction to supply USD 6 billion in one-month funds.

22 April (cont.)	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
24 April	Fed	Other	Conducted TSLF auction with offering amount USD 75 billion (against Schedule 2 collateral).
29 April	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
1 May	BoC	Longer-term operation	Conducted term PRA transaction to supply CAD 2 billion of 28-day funds (to mature on 29 May).
	Fed	Other	Conducted TSLF auction with offering amount USD 25 billion (against Schedule 1 collateral).
2 May	SNB, ECB, Fed	Communication	Fed: Announced increase in size of TAF auctions to USD 75 billion each; expansion of eligible collateral for Schedule 2 TSLF auctions to include AAA/Aaa-rated ABSs. Increased the existing swap line with the ECB to USD 50 billion and that with the SNB to USD 12 billion. Extended the swap lines' term to 30 January 2009. SNB: Announced increase in frequency of USD repo auctions to bi-weekly, while keeping size at USD 6 billion each. ECB: Announced increase in the size of TAF auctions to USD 25 billion each.
	BoE	Other	Set reserve target ceiling for each reserve scheme member as the higher of GBP 2.5 billion and 5% of its sterling eligible liabilities, with effect from the maintenance period starting on 8 May.
5 May	ECB	Longer-term operation	Conducted TAF auction to supply USD 25 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction to supply USD 75 billion in one-month funds.
6 May	SNB	Longer-term operation	Conducted USD repo auction to supply USD 6 billion in one-month funds.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.

7 May	BoE	Other	Announced that reserves banks had raised their aggregate reserves targets by 5% for the May maintenance period. Ranges around reserves targets remained at ±30%.
8 May	Fed	Other	Conducted TSLF auction, offering amount USD 50 billion (Schedule 2 collateral).
13 May	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
15 May	BoC	Longer-term operation	Conducted term PRA transaction to supply CAD 2 billion of 28-day funds (to mature on 12 June).
	Fed	Other	Conducted TSLF auction, offering amount USD 25 billion (Schedule 1 collateral).
19 May	ECB	Longer-term operation	Conducted TAF auction to supply USD 25 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction to supply USD 75 billion in one-month funds.
20 May	SNB	Longer-term operation	Conducted USD repo auction to supply USD 6 billion in one-month funds.
	BoE	Longer-term operation/ collateral	Conducted an expanded three-month OMO against a wider range of collateral, for a reduced amount of GBP 1.6 billion. Announced that it would maintain its expanded three-month OMOs on 17 June and 15 July. With the launch of the Special Liquidity Scheme, these OMOs would be reduced to GBP 5 billion each.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
21 May	ECB	Longer-term operation	Conducted a supplementary three-month LTRO of EUR 50 billion (as announced on 28 March).
22 May	Fed	Other	Conducted TSLF auction, offering amount USD 75 billion (Schedule 2 collateral).
27 May	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
29 May	BoC	Longer-term operation	Conducted term PRA transaction at a reduced amount of CAD 1 billion (to mature on 26 June), in the light of improved market conditions.

29 May (cont.)	Fed	Other	Conducted TSLF auction, offering amount USD 25 billion (Schedule 1 collateral).
		Communication	Announced that it would conduct TAF auctions of USD 75 billion each on 2, 16 and 30 June.
2 June	ECB	Longer-term operation	Conducted TAF auction to supply USD 25 billion in one-month funds.
	Fed	Longer-term operation	Conducted TAF auction to supply USD 75 billion in one-month funds.
3 June	SNB	Longer-term operation	Conducted USD repo auction to supply USD 6 billion in one-month funds.
	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
4 June	BoE	Other	Announced that reserves banks had raised their aggregate reserves targets by 6% for the June maintenance period. Ranges around reserves targets remained at ±30%.
5 June	Fed	Other	Conducted TSLF auction, offering amount USD 50 billion (Schedule 2 collateral).
9 June	ECB	Communication	Announced that it "continues to closely monitor liquidity conditions and notes some tensions in money market rates for maturities over the end-of-semester […] remains ready, if needed, to smooth conditions around the end-of-semester".
10 June	Fed	Longer-term operation	Conducted a single-tranche OMO to provide USD 20 billion in 28-day funds.
11 June	ECB	Longer-term operation	Conducted a supplementary three-month LTRO of EUR 50 billion (as announced on 28 March).
12 June	BoC	Longer-term operation	Conducted term PRA transaction at a reduced amount of CAD 1 billion (to mature on 10 July), in the light of improved market conditions.
	Fed	Other	Conducted TSLF auction, offering amount USD 25 billion (Schedule 1 collateral).

Annex 2
Mandate of the Study Group on Central Bank Instruments

Recent, indeed still ongoing, financial turbulence has exposed the vulnerability of the global financial system to shocks to market and funding liquidity. In particular, the persistent lack of liquidity in interbank money markets has surprised observers. One key aspect of understanding the recent turmoil is whether and how central banks tried to address this development, what their objectives were, how their responses were shaped by practice and by various (eg legal) constraints and whether their actions were effective.

The CGFS, in line with its mandate to support central banks in the fulfilment of their responsibilities for monetary and financial stability, will review this particular aspect of recent events, in cooperation with the Markets Committee. The study will address five main questions, which could also correspond to the chapters of the Group's report.

- Facts: What factors led to the evaporation of liquidity, particularly in overnight and term interbank money markets? How did developments in commercial paper and swap markets affect interbank money markets? What problems for the financial system did this phenomenon cause or exacerbate? Why were money markets in some countries affected more than in others? Which specific market developments or signals triggered specific central bank actions?
- Central bank actions: How did central banks address these developments – in terms of open market operations, discount window or standing facility credit and the monetary policy implementation framework in general (eg minimum reserves)? How damaging was the stigmatisation of borrowing from standing facilities and how did central banks deal with it? How did the foreign currency funding needs of international banks influence central bank choices? Was there a risk of blurring the boundary between liquidity operations and monetary policy? What responsibility does the central bank have for the functioning of term money markets? Did variations across central banks in collateral eligibility reduce the effectiveness of central bank action?
- Central banks' communication and interaction with the markets: What was the role of communication with the general public, financial institutions and other central banks? How did central bank actions interact with market participants' behaviour? What additional information provided to, and collected from, markets was particularly useful?
- Results: In what way did central banks affect market conditions, especially in money and related markets (including FX swap markets, markets for interest rate derivatives priced against Libor, etc)? Was this what the central banks intended? To what extent were deviations from operational targets viewed as acceptable?
- Innovations: To what extent did central banks have to innovate their monetary policy implementation framework during the recent turbulence? How were the responses of central banks shaped by various constraints? Did they have sufficient tools at their disposal to accomplish their objectives? What else might be desirable?

The review would not touch on the more general issue of the causes and consequences of the market turbulence unless relevant to central bank decisions. Based on the discussion of these questions, the study could draw some tentative lessons.

A CGFS Study Group of central bankers overseeing monetary operations in the "largest" currency areas will prepare a preliminary report. All CGFS central banks will have the

opportunity to comment on the draft report at a meeting in mid-February. The Study Group will report back to the CGFS in March 2008.[19]

[19] The Study Group will initially draw as much information as possible from existing material, eg written material, published or non-published, available in central banks as well as from the basic information on liquidity management collected by the Markets Committee.

Annex 3
Members of the Study Group and other central bank contributors

Members of the Study Group

Chairperson, European Central Bank	Francesco Papadia
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Bank of Japan	Hiroshi Nakaso
Bank of Spain	Javier Alonso
Swiss National Bank	Thomas Jordan
Bank of England	Paul Tucker
Board of Governors of the Federal Reserve System	Brian Madigan
Federal Reserve Bank of New York	William Dudley
Bank for International Settlements	William Nelson (Secretary until April 2008) Corrinne Ho (Secretary from May 2008) Dietrich Domanski François-Louis Michaud

Other participants in the enlarged meeting in Frankfurt, February 2008

Reserve Bank of Australia	John Veale
National Bank of Belgium	Eddy De Koker
People's Bank of China	Wang Yang
Bank of France	Isabelle Strauss-Kahn Laurent Clerc
Deutsche Bundesbank	André Bartholomae
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Bank of Italy	Emerico Zautzik
Bank of Korea	Tae-yong Kwon
Central Bank of Luxembourg	Nicolas Weber
Netherlands Bank	Tom Van Veen
Sveriges Riksbank	Mattias Persson
Bank of England	Roger Clews