12-1-2009

The collateral frameworks of the Eurosystem, the Federal Reserve System and the Bank of England and the financial market turmoil

Samuel Cheun

Isabel von Koppen-Mertes

Benedict Weller

Cheun, Samuel; von Köppen-Mertes, Isabel; Weller, Benedict

Research Report

The collateral frameworks of the Eurosystem, the Federal Reserve System and the Bank of England and the financial market turmoil

ECB Occasional Paper, No. 107

Provided in Cooperation with:
European Central Bank (ECB)

Suggested Citation: Cheun, Samuel; von Köppen-Mertes, Isabel; Weller, Benedict (2009) : The collateral frameworks of the Eurosystem, the Federal Reserve System and the Bank of England and the financial market turmoil, ECB Occasional Paper, No. 107, European Central Bank (ECB), Frankfurt a. M.

This Version is available at:
http://hdl.handle.net/10419/154560

EUROPEAN CENTRAL BANK
EUROSYSTEM

OCCASIONAL PAPER SERIES
NO 107 / DECEMBER 2009

THE COLLATERAL FRAMEWORKS OF THE EUROSYSTEM, THE FEDERAL RESERVE SYSTEM AND THE BANK OF ENGLAND AND THE FINANCIAL MARKET TURMOIL

by Samuel Cheun,
Isabel von Köppen-Mertes
and Benedict Weller

EUROPEAN CENTRAL BANK

EUROSYSTEM

OCCASIONAL PAPER SERIES

NO 107 / DECEMBER 2009

THE COLLATERAL FRAMEWORKS OF THE EUROSYSTEM, THE FEDERAL RESERVE SYSTEM AND THE BANK OF ENGLAND AND THE FINANCIAL MARKET TURMOIL

by Samuel Cheun [1], Isabel von Köppen-Mertes [1] and Benedict Weller [1]

In 2009 all ECB publications feature a motif taken from the €200 banknote.

This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=1325248.

1 *The authors would like to thank Spence Hilton, Roger Clews, Gerard Korteweg, Nuno Cassola, Michel Stubbe, Denis Blenck, Francesco Papadia, Ulrich Bindseil and Laura Cerami for providing comments on previous drafts.*

Address
Kaiserstrasse 29
60311 Frankfurt am Main
Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main
Germany

Telephone
+49 69 1344 0

Website
http://www.ecb.europa.eu

Fax
+49 69 1344 6000

ISSN 1607-1484 (print)
ISSN 1725-6534 (online)

CONTENTS

ABSTRACT

In response to the turmoil in global financial markets which began in the second half of 2007, central banks have changed the way in which they implement monetary policy. This has drawn particular attention to the type of collateral used for backing central banks' temporary open market operations and the range of counterparties which can participate in these operations. This paper provides an overview of the features of the different operational and collateral frameworks of three central banks that have been significantly affected by the crisis: the Eurosystem, the Federal Reserve System and the Bank of England. The paper describes the factors that shaped the three frameworks prior to the turmoil. It then describes the actions the three central banks took in response to the turmoil and analyses to what extent these actions were dependent on the initial design of the operational and collateral framework.

Keywords: Collateral Framework, Central Bank Repo Auctions, Collateral, Open Market Operations, Financial Market Turmoil 2007-2009

JEL classification: E52, E58, G01, G20

NON-TECHNICAL SUMMARY

Prior to the financial market turmoil that began in 2007, the Eurosystem, the Federal Reserve System and the Bank of England had very different operational frameworks for the implementation of monetary policy, in particular regarding the type of securities that were eligible as collateral for obtaining credit from the central bank. The Eurosystem, on the one hand, accepted a very broad range of collateral in its main open market operations, and also allowed a broad range of banks to participate. Furthermore, Eurosystem open market operations were of large size and there was no differentiation in the interest rate charged in the auctions depending on the type of collateral. The Federal Reserve, in contrast, only accepted government and quasi-government securities as collateral in its temporary operations, operating with a narrow group of less than 20 counterparties. Furthermore, its temporary operations were of a small size, and the Federal Reserve even charged different interest rates in the auctions depending on the type of collateral in order to minimise any impact of its operations on asset prices. The Bank of England ranged somewhat between these two extremes, but clearly closer to the Federal Reserve's model than the Eurosystem's.

This paper explains what factors, both external and internal, may have affected the choice of collateral and other differences in the operational frameworks. External factors include the legal constraints under which the central bank operates, as well as the depth and liquidity of the country's capital markets and the structure of its banking system. Internal factors include how the central bank chooses to supply liquidity to the banking sector (i.e. whether mainly through outright or temporary operations), the importance the central bank places on not affecting market prices of assets, whether the central bank differentiates collateral eligibility according to the type of operation, and whether it applies large or small reserve requirements.

Following the start of the financial market turmoil, which turned into the equivalent of a traditional bank run but taking place in the wholesale funding markets, it became clear that central banks needed to provide banks with funds against less liquid collateral in order to prevent a systemic crisis. The Federal Reserve and the Bank of England, which at the outset of the turmoil had a narrower range of counterparties and collateral, expanded their operations significantly. In particular, both central banks started to accept asset-backed securities issued by the private sector as collateral, the asset class which had triggered the turmoil and had turned the most illiquid due to uncertainties about credit quality and valuation. The Eurosystem's framework, in contrast, which had already for many years accepted asset-backed securities as collateral in its liquidity-providing operations, was flexible enough to accommodate banks' additional demand for liquidity with relatively few adjustments.

By the spring of 2009, the Federal Reserve had adopted such a large range of new facilities that the amount of liquidity provision – measured by four criteria: the size of the operations, the type of collateral, the range of eligible counterparties and the interest rate – was equivalent or arguably more 'accommodative' than the Eurosystem's. However, this turned out to be a temporary phenomenon, as many of the Federal Reserve's programmes began to automatically unwind as market conditions started to improve during the summer and autumn of 2009 and the provision of liquidity decreased quite markedly. At the same time, with the introduction of the Eurosystem's one-year main refinancing operation in the summer of 2009, the Eurosystem's liquidity provision continued to remain rather accommodative.

The high level of what might be called "liquidity insurance" provided by the Eurosystem both before and after the start of the crisis certainly has benefits in terms of an immediate crisis mitigation tool. There was no time delay necessary before implementing new facilities, and the framework provided a very high

degree of flexibility for banks to minimise their funding liquidity risk, without prompting fire sales. Of course, these benefits of a "broad" framework have to be weighed against potential disadvantages, in particular the higher risks of accepting more illiquid collateral and the associated challenges for the risk control framework. Furthermore, the acceptance of a broad range of collateral in regular, large scale temporary central bank operations may undermine the incentive for banks prudently to manage liquidity risk.

I INTRODUCTION

Central banks implement monetary policy by steering short-term market interest rates close to the central banks' policy rate.[1] Normally, the steering of interest rates is achieved by conducting liquidity-providing, or absorbing, operations with private sector financial institutions ("counterparties") via discretionary temporary open market operations which are initiated by the central bank. Central banks also normally offer a liquidity providing standing facility, where counterparties can borrow at any time on their own initiative although only at a penal rate, and a deposit facility, whereby counterparties can have excess funds remunerated although only at below market rates. Traditionally standing facility operations – both the marginal lending facility and the deposit facility – were also used to steer interest rates on a day-to-day basis, but now they mainly play a supporting role, acting as a ceiling on and a floor to market interest rates.

Central banks can also conduct two other types of liquidity-providing operations, which are generally not related to the day-to-day steering of interest rates, namely outright operations and intraday credit operations. Outright operations are normally associated with the management of an "outright asset portfolio", which often mirrors the long-term trend increase in the issuance of currency in circulation (e.g. in the case of the central banks of the US and Japan). Intraday credit operations are used by the central bank in its role at the centre of the payment system, to facilitate the settlement of intraday payment flows between institutions that hold their accounts at the central bank.

Outright operations involve the purchase of securities in the "open market", which are normally kept on the central bank's balance sheet until maturity.[2] In contrast, temporary open market operations, standing credit facilities, and intraday credit are all forms of collateralised lending (i.e. credit operations) in which central bank money is granted to counterparties at a fixed maturity against certain eligible assets,[3] which act as security in the event that the counterparty does not repay. Unlike in outright operations, the central bank does not become the permanent owner of the securities in temporary operations.[4]

The potentially wide range of operations available to central banks provides significant flexibility to operate effectively in a wide range of different market conditions. This flexibility proved particularly pertinent during the prolonged difficulties in financial markets in 2007-2009, when many central banks had to innovate in terms of liquidity-providing operations in order to deal with specific problems among banks and financial markets.

This paper provides an overview of the specific features of the different collateral frameworks of three central banks that have been significantly affected by the crisis: the Eurosystem, US Federal Reserve and Bank of England. It explains why their frameworks were established in the way that they were, and how this had an impact on the responses of the three central banks to the turmoil in terms of using innovative liquidity-providing operations or introducing new types of collateralised lending facilities. The paper is structured as follows: Chapter 2 describes the operational context and the factors that shaped the original design of the collateral frameworks. Chapter 3 describes the actions central banks took in response to the turmoil and how these actions were affected by the set-up of the operational and collateral framework prior to the turmoil. Chapter 4

1 Annex 1 summarises the main features of the monetary policy operational frameworks of the Eurosystem, the Federal Reserve and the Bank of England.
2 As the volume of banknotes in circulation has a fairly stable and predictable long-term upward trend, outright purchases of securities can normally be held to maturity without it being necessary to sell prior to maturity.
3 In the case of the Federal Reserve, intraday credit is not collateralised up to certain overdraft limits.
4 In a repurchase (or "repo") transaction using the usual master repo agreements, the central bank legally becomes the owner of the securities, but only for the period of the transaction. In the case of central bank lending operations based on a "pledge" of the collateral, the counterparty remains the owner of the security and the central bank only needs to resort to appropriation procedures in the event of default.

specifically compares the role of temporary open market operations in the three central banks' responses to the crisis, using a range of criteria to determine how accommodative they have been in alleviating strains in wholesale interbank markets and dislocated asset markets. Chapter 5 contains the conclusions and suggests avenues for future research.

2 FACTORS INFLUENCING THE COLLATERAL FRAMEWORK

It is a universal central banking principle that credit should only be granted to private sector counterparties against collateral. There are several reasons why collateralised (or "secured") lending is preferable to unsecured lending, but the most important is that it protects the central bank against financial losses.[5] Central banks are public sector institutions so they have an obligation to act prudently with taxpayers' money; significant losses may threaten the central bank's reputation. Furthermore, if a central bank were to incur very large losses, it might risk losing its credibility in maintaining price stability.[6]

Although the requirement for collateral is frequently included in a central bank's statute, the central bank itself normally decides what constitutes "sufficient" or "adequate" collateral. The principal objective of ensuring a very high degree of protection against financial loss could, in theory, be achieved in two ways: (i) either by only accepting assets with a very low credit, market and liquidity risk, e.g. government bonds; or (ii) by accepting a wider range of collateral, with varying degrees of credit, market and liquidity risk, but applying sufficiently high valuation "haircuts" (i.e. reducing by a certain percentage[7] the value of the collateral against which lending is provided) or other risk control measures to ensure that the residual financial risks, after the collateralisation and the application of the risk control framework, are identical to the first approach.

In private interbank repo markets, there is a strong tendency to opt for the former approach, with the vast majority of collateral consisting of government bonds; repo markets in non-government bond collateral are still negligible in most developed countries, with the exception of US agency bonds.[8] For example, according to a December 2008 survey by the European Repo Council, 83.6% of the outstanding €4.6 trillion private repo transactions in Europe are collateralised by government bonds. Similarly, in the US, prior to the crisis, the percentage of central government bond collateral in the total outstanding repo transactions was also high, at approximately 81%.[9]

Within the central banking community, however, there is much more variation. Some central banks (e.g. the Federal Reserve, the Bank of England and the Bank of Canada) have tended to adhere more strictly to the first approach, accepting only central government or quasi-government bonds for open market operations. Other central banks (e.g. the Eurosystem and Bank of Japan),

5 Secured lending also removes the burdensome task of having to monitor very actively individual counterparties' creditworthiness, as well as of calculating and monitoring credit limits. It may also help to guard against adverse selection, i.e. the fact that, in the absence of limits, the borrowers from the central bank would tend to be those with the lowest creditworthiness.

6 In theory, central banks could operate with negative capital indefinitely, and might only need recapitalisation if it were to have very large liabilities denominated in a foreign currency which it could not repay by creating domestic currency, or if the economy were to enter a very strong deflationary spiral, which would not allow the central bank to return to profitability through its seigniorage revenue. Of course, this does not take into account what may happen to the ability to control inflation as a result of negative public expectations of a central bank having negative equity. For further information, see, for instance, Cincibuch, Holub and Hurnik (2008) and Bindseil, Manzanares and Weller (2004).

7 For example, assume that a bond on day T has a market value at par 100 and the central bank applies a 5% haircut to such collateral in its credit operations. The counterparty would be able to borrow only 95 against such collateral. Furthermore, if the market price were to decrease to 90 the following day (T+1), the bank would be able to borrow 95% of the new market value 90, i.e. 85.5.

8 One possible reason which could be inhibiting the private sector from adopting a broader range of collateral has been indicated by Ewerhart and Tapking (2008), i.e. the default risk of the collateral taker. The "market failure" is due to the following reason: for very risky collateral, it would be necessary to apply very high haircuts. However, there is also a risk that the cash provider may go bankrupt, which prevents the collateral provider from using this type of collateral.

9 According to the latest breakdown in the Securities Industry and Financial Markets Association (SIFMA) report for the first quarter of 2008, the average daily volume of total outstanding repo contracts totalled USD 7.06 trillion, with US Treasury notes, bonds and bills accounting for in total 81%, followed by Federal agencies (11.2%), and other (7.9%), which includes discount agencies, Treasury Inflation-Protected Securities (TIPS), and more.

have decided to accept a broad range of both public and private sector claims as collateral, veering closer to the second approach than the first. The explanation for these different approaches is that central banks must take into account a different range of factors from private institutions. In particular, they are concerned to ensure the effective implementation of monetary policy and, in the case of some central banks, also about the smooth functioning of payment systems, while taking into account the constraints imposed by the external environment (i.e., the central bank's statutory requirements and the structure and development of domestic capital markets and the local banking sector). Thus, the interpretation of "adequacy of collateral" given by different central banks depends on the design of the operational framework and external factors shaping the supply and demand of collateral. The choice of collateral is a residual decision after the other, arguably more important, decisions are made.

The following subsections distinguish between the impact of the external environment and internal choices determining the set-up of the collateral framework of a central bank. Since there are many interdependencies between external and internal factors, the distinction is stylised and, to a certain extent, artificial.

2.1 EXTERNAL ENVIRONMENT

Before making any decisions on how it should implement monetary policy, a central bank needs to take into account a number of possible constraints imposed by its external environment: (i) any legal restrictions imposed by the central bank's statute; (ii) the state of development and depth of financial markets; and (iii) the structure of banking sector. For example, if a country had very limited or even non-existent capital markets, it would not make sense to have only marketable securities as collateral. On similar grounds, if the banking sector was highly concentrated, a central bank would only need to deal with a small range of counterparties.

2.1.1 LEGAL RESTRICTIONS

The legal restrictions under which central banks operate under have a direct impact on their operational and collateral frameworks.

In the case of the Eurosystem, there is a legal requirement that the central bank cannot purchase public sector securities on the primary market, although it can do so on the secondary market. Similarly, the Eurosystem is forbidden from lending directly to public sector institutions. Furthermore, in its collateral framework, the Eurosystem is also obliged not to treat public sector issuers more favourably than private sector issuers, except where this is justified by objective considerations, such as levels of credit or liquidity risk. These statutory requirements make it possible for the Eurosystem to accept a wide range of assets, not only in its capacity as lender of last resort, but also in the implementation of monetary policy.

In the case of the Federal Reserve, lending to depository institutions in the capacity of lender of last resort and conducting open market operations to implement monetary policy are viewed as very distinct activities of the central bank. They are even governed by different bodies: the Board of Governors and the Federal Open Market Committee (FOMC), respectively. The Federal Reserve Act (FRA) restricts discount window lending to banks, except under "unusual and exigent conditions". Under the FRA a wide range of collateral is eligible for this safety valve purpose. Decisions on the types of collateral that are acceptable are at the discretion of the Reserve Bank, although in practice these policies are coordinated for the entire Federal Reserve. By contrast, collateral eligible for open market operations is very restricted under the FRA: only Treasury, agency, and agency mortgage-backed securities (MBSs) are accepted. In principle, open market operations are open to all types of financial institutions.

The Bank of England is not constrained by any statutory requirements regarding its eligible collateral.

2.1.2 STATE OF DEVELOPMENT OF CAPITAL MARKETS

The state of development of a country's capital markets can have a significant impact on how monetary policy is implemented. In order to compensate for the withdrawal of liquidity that results mainly from the issuance of banknotes in circulation, as well as the additional demand for liquidity created by required reserves, central banks can provide liquidity to the banking sector by means of outright or temporary open market operations. The central bank's decision on whether to use primarily outright or temporary operations depends on whether capital markets are deep enough in relation to the liquidity that needs to be provided to the banking sector. The central bank is only in a position to operate a monetary outright portfolio on a permanent basis without creating market distortions if capital markets are deep enough.

When the Eurosystem designed its operational framework, it needed to take into account the diverse national financial markets at the start of 1999. The technical problems arising from the lack of a single euro area government bond market were one of the reasons why the Eurosystem did not establish an outright portfolio earmarked for monetary policy purposes until the launch of its Covered Bond Purchase Programme in July 2009. In the absence of a monetary policy outright portfolio, the Eurosystem operated with very large temporary operations, amounting to €466 billion (38% of its balance sheet in July 2007) before the onset of the turmoil.

This had an impact on the collateral policy of the Eurosystem. All other things being equal, the larger the volume of central bank temporary operations relative to the size of the domestic government bond market, the greater the need to expand the eligibility of collateral to private sector securities or non-marketable assets (see sub-section 2.2.2). In the United States, the ratio of temporary operations to the size of the domestic government bond market was, before the current crisis, very low at 1:200 due to the relatively narrow role for temporary operations in the Federal Reserve's operational framework; while for the Eurosystem it was much higher at 1:10, and in the case of the Bank of England the ratio was even higher at 1:9, indicating that these latter two central banks would face greater collateral constraints if only domestic government bonds were eligible.[10]

Another factor influencing the Eurosystem collateral framework was the fact that it was a more traditional bank-based financial system, with relatively undeveloped private sector bond markets. The funding of residential mortgages in the euro area was and still is predominantly done through retail deposits. For example, it is estimated[11] that retail deposits accounted for approximately 60% of €6.1 trillion of outstanding residential mortgage balances in the EU 27 in 2007, with only 27% funded through mortgage-related securities (16% through covered bonds and 11% through mortgage-backed securities), with the remainder funded through unsecured borrowing. Additionally, the corporate bond market in the euro area was relatively underdeveloped as companies have traditionally obtained financing from banks or by using retained profits rather than the capital markets. This prominent role of loans in the Eurosystem and the limited scale of securitisation of loans to small and medium-sized enterprises (SMEs) was one of the reasons why the Eurosystem developed a euro area-wide eligibility framework for bank loans, which was launched at the start of 2007.[12]

10 All data is from July 2007, prior to the onset of the financial turmoil.

11 See European Mortgage Federation (2007), Hypostat.

12 Some have argued that by accepting corporate loans as collateral, the Eurosystem may be hampering the development of SME loan securitisation. But it seems more likely that other factors are more important in impeding the market, in particular the lack of homogeneity of the SME loan market and the lack of balance sheet data over the cycle. Furthermore, banks would most likely wish to securitise the lower credit quality loans; given that the Eurosystem minimum credit threshold is rather high at single A- (although reduced to BBB- during the financial turmoil), banks would probably wish to retain these higher quality loans on their balance sheet.

In addition to having a more bank-based financial system, the Eurosystem's collateral framework was also influenced by the ongoing integration of the euro area financial markets. One of the clearest consequences of this environment was the establishment of a two-tier collateral framework, with the first tier based on euro area-wide harmonised eligibility criteria and the second tier targeted towards the specific needs of the national banking sectors. Although the level of segmentation in financial markets has subsided significantly since the launch of the euro, leading to the phase-out of the two-tier list in 2007, some segments of the market remain less than fully integrated and continue to impact on the Eurosystem's collateral policy.[13]

In contrast, thanks to the ample supply of US Treasury debt (and associated well-developed government securities markets), the Federal Reserve has faced relatively few constraints concerning the design of its operational framework. Prior to the onset of the turmoil, the Federal Reserve had a very large outright asset portfolio, amounting to approximately 91% of its balanced sheet, and composed mostly of US Treasuries. Temporary operations amounted to only USD 23 billion or 3% of its balance sheet in July 2007. An important challenge, however, did occur in the late 1990s and early 2000s, when the Federal Reserve considered a range of solutions to address expectations of persistent US Treasury budgetary surpluses which could have led to a scarcity of US Treasury securities. The range of solutions included expanding the range of assets for its outright operations to include non-Treasury securities and modifying and expanding its discount window (in a very similar way to the Term Auction Facility (TAF) that was eventually implemented at the end of 2007; see Chapter 3). As a part of this process, the Federal Reserve also assessed whether these changes to its operational framework would still comply with its core principles, in particular the effective implementation of monetary policy and the desire to minimise the impact on market prices. Ultimately, the surpluses turned into deficits and the concerns over the scarcity of US Treasury securities disappeared; therefore no measures were implemented by the Federal Reserve at the time.

In the case of the Bank of England, the relatively high ratio between the size of temporary operations and the domestic government bond market may have played a role in its decision in the early 2000s to expand eligible collateral to cover all euro area government bonds above a certain rating threshold. This allowed the Bank to expand significantly the amount of eligible collateral, while still restricting itself to high quality government bonds.

2.1.3 BANKING STRUCTURE AND ACCESS BY COUNTERPARTIES

A second important aspect of the central bank's environment that affects the design of the collateral framework is the choice of counterparties that may participate in the various central bank operations. This is because, all else being equal, the wider the range of counterparties, the more diverse the types of collateral asset held on their balance sheets are likely to be. If the central bank wants to ensure that this broad range of counterparties is able to participate on an approximately equal basis, then it also needs to accept a broad range of collateral.

This is certainly the case in the euro area. The Eurosystem has always placed a strong emphasis on ensuring that a broad range of counterparties can access central bank operations for two reasons. First, in order to ensure a level playing field, it is necessary to take account of the difference in countries' banking structure. Specialised banks, in particular, still play an important role in many euro area countries, which adds to the heterogeneity

13 At the same time, the Eurosystem's collateral framework has also had some positive effects in terms of fostering the integration of financial markets. For example, through the establishment of the Correspondent Central Banking Model (CCBM), the Eurosystem has facilitated the use of collateral on a cross-border basis in credit operations with the Eurosystem, thereby providing an additional incentive for counterparties to diversify their portfolios across assets in different countries. As a result, the use of collateral on a cross-border basis in credit operations with the Eurosystem increased from 12% in 1999 to more than 50% by 2006.

of the asset composition on banks' balance sheets. Second, on a more practical level, there is still much more room for national and especially cross-border banking consolidation, and with few, if any, fully European banks, it is difficult to make a selection of only a small number of counterparties. In order to achieve a broad participation, the Eurosystem allows all credit institutions subject to minimum reserve requirements to participate in the main temporary operations, provided they are deemed financially sound by national supervisors and meet some basic operational requirements. Those requirements do not require active participation in private repo markets, as the Eurosystem operates temporary operations that are particularly designed for monetary policy purposes. Currently, this means that about 1,700 institutions are eligible to participate in regular open market operations (i.e. around 30% of all credit institutions). Typically, the number of participating institutions has fluctuated between 300 to 400 (338 on average during 2007), but this number increased during the period of financial turmoil, averaging 443 during 2008 and 747 since the policy shift to the fixed rate full allotment tenders in October 2008.

In contrast, in line with the provisions under the FRA, the Federal Reserve distinguishes between depository institutions (banks) that have access to primary credit (discount window) lending, and counterparties that are eligible for its open market operations. All 7,000 depository institutions that have a reserve account with the Federal Reserve and an adequate supervisory rating have access to the discount window against a very broad range of collateral.[14] However, lending to banks through the discount window has historically not been a regular part of managing the Federal Reserve's balance sheet and the discount window has largely served the function of "lender of last resort".

In principle, the Federal reserve's open market operations are open to all types of financial institutions in principle. However, given the narrow role of temporary operations and the fact that the Federal Reserve operates directly in the private repo market for collateral accepted under the FRA, the Federal Reserve has traditionally relied on a small group of primary dealers (currently 18) for this purpose. The main restriction for these counterparties is that they must be active in government and agency securities markets in which the open market operations are arranged. The primary dealers serve as the medium for making adjustments to the aggregate stock of reserve balances, and the redistribution of these balances occurs in the federal funds market.

Similar to the Federal Reserve, the Bank of England limited participation in its open market operations to a small sub-set of its largest clearing banks (around five institutions) until 2006, when a major reform of its operational framework took place. This reform introduced a system of voluntary reserve requirements and widened the range of counterparties. The Bank of England does not publish the names of the institutions that are eligible to participate in its operations, but it is likely to be broader than the Federal Reserve yet narrower than the Eurosystem (i.e. between 5% and 10% of the 400 resident banks).

2.2 INTERNAL CHOICES

While the external environment is a given for the central bank, there are other aspects in the design of the operational framework which can then influence the choice of collateral: (i) the central bank's guiding principles; (ii) the size and composition of the central bank's balance sheet; and (iii) whether collateral eligibility is differentiated according to the type of operation. This section analyses these factors.

14 There are also differences in the way in which central banks assess the financial soundness of their counterparties. Because of its additional role as a banking supervisor, the Federal Reserve has access to internal supervisory ratings which help it to distinguish between the banks eligible for the primary and secondary credit facilities. The ECB, on the other hand, does not supervise banks and, depending on the local set-up, this task is carried out either by the national central bank (NCB) or by an independent national supervisory agency (or a combination of both).

2.2.1 THE CENTRAL BANK'S GUIDING PRINCIPLES

Central banks implicitly or sometimes explicitly design their operational frameworks on a number of principles (see Box 1). While there are a number of common principles between the three central banks, in particular the desire to have balance sheet flexibility and/or sufficiency of collateral to be able to achieve monetary policy, payment system, and even financial stability objectives, there are some differences that may have also had an impact on the design of the collateral framework.

Box 1

PRINCIPLES OF CENTRAL BANK OPERATIONAL FRAMEWORKS

In the case of the Eurosystem,[1] the key principles have not been stated explicitly, but can be derived mostly from the Treaty establishing the European Community and the Protocol on the Statute of the European System of Central Banks and of the European Central Bank:

- Collateral must protect the Eurosystem from incurring losses in its credit operations.
- The volume of collateral available to counterparties must ensure that the Eurosystem can effectively conduct monetary policy operations and promote the smooth operation of the payment system.
- Eurosystem operations should be equally accessible to a broad set of counterparties.
- Eligible collateral should offer cost-efficient transfer and mobilisation conditions, credit risk evaluation and monitoring possibilities.
- The Eurosystem must act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources.
- The collateral framework should be simple and transparent.
- There should be no special or privileged treatment of public sector securities.

The Federal Reserve[2] has outlined four principles for managing its assets:

- The Federal Reserve must have effective control over the stock of high-powered money and the size of its balance sheet.
- The Federal Reserve should structure its portfolio and undertake its activities so as to minimise their effect on relative asset values and credit allocation within the private sector.
- The Federal Reserve should manage its portfolio to minimise risks in a manner consistent with the achievement of its goals and to maintain sufficient liquidity to be able to conduct potentially large actions at short notice.
- The Federal Reserve should place a high priority on transparency and accountability.

For the Bank of England,[3] market operations have two core objectives, stemming from its monetary policy and financial stability responsibilities, as well as two other considerations:

- To implement monetary policy by maintaining overnight market interest rates in line with Bank Rate, so that there is a flat risk-free money market yield curve to the next Monetary Policy Committee decision date, and there is very little day-to-day or intraday volatility in market interest rates at maturities out to that horizon.

1 See Box 1 in European Central Bank (2008b).
2 See Federal Reserve Board (2002).
3 See Chapter II of Bank of England (2008b).

- To reduce the cost of disruptions to the liquidity and payments services supplied by commercial banks. The Bank does this by balancing the provision of liquidity insurance against the costs of creating incentives for banks to take greater risks, and subject to the need to avoid taking risk onto its balance sheet.
- For market operations to have broadly neutral effects on relative asset prices, in normal circumstances.
- To foster competitive and fair sterling money markets.

One of the more notable differences concerns the preference for market neutrality, i.e. to desire to minimise the effect of operations on relative asset prices or the allocation of credit. Generally, temporary repo operations have a much lower impact on asset prices than outright purchases because the credit and market risk of the collateral remains with the counterparty. Nevertheless, an impact on asset prices cannot be entirely excluded: by granting collateral eligibility to an asset, a central bank may increase the liquidity of the asset, raising its value in the secondary market relative to assets that are not eligible. This, in turn, could enhance the ability of issuers to obtain credit from the private sector for this asset relative to assets that are not eligible.

Prior to the financial turmoil, the Federal Reserve maintained a strong focus on market neutrality in the conduct of its open market operations. It had this ability since the type of securities permitted by the FRA in open market operations – US Treasury securities, along with agencies and agency MBSs – are characterised by relative safety, credit neutrality, and ample supply. Prior to the turmoil, the Federal Reserve held a large volume of US Treasury securities in its outright portfolio. Due to the breadth and depth of the US Treasury market, the Federal Reserve was able to conduct outright operations with minimal distortions to prices.[15] This preference for market neutrality has also carried over to the temporary open market operations that are conducted in different tranches, depending on the type of collateral submitted, i.e. Treasuries, agencies, and agency MBSs, with stop-out rates determined by the market repo rates for the different collateral. In a sense, the Federal Reserve operated in these markets as if it was just another "market player", albeit a very large and important one, adopting the same instruments, market conventions, collateral requirements, risk management practices, and so on.

This focus on market neutrality can also be seen in early 2000, when the Federal Reserve introduced limits on the volume of individual Treasury securities that it could purchase for its outright portfolio amidst concerns about the shrinking supply of government securities. The limits were intended to help avoid creating supply constraints along the yield curve.

Similarly, the Bank of England has also maintained a focus on market neutrality. The main temporary open market operations have traditionally been conducted in a single-tranche auction in which eligible collateral for the operation is limited to only government or quasi-government bonds.

In contrast, the Eurosystem has prioritised the sufficient availability of collateral and a level playing field across counterparties. Given significant fragmentation of capital markets in the euro area and the lack of consolidation of the banking sector (on both a national and cross-border level), it has focused its attention on ensuring a low cost and abundance of

15 In managing the portfolio, the Federal Reserve has avoided purchases on days of high market volatility and has avoided purchasing securities that were in high demand. Moreover, the Federal Reserve has made its portfolio of securities available to the market through its securities lending operations.

collateral for counterparties. It has adopted a policy of pooled collateral for all different types of operations, with no price discrimination. In doing so, the Eurosystem has accepted that its operations could potentially have an effect on market equilibria. However, the lack of consolidation in the banking sector and the fragmentation of capital markets would have hampered efforts to be market neutral like the Federal Reserve and the Bank of England.

2.2.2 CENTRAL BANK BALANCE SHEET SIZE AND COMPOSITION

As indicated in sub-section 2.1.1, the central bank's decision on whether primarily to use outright or credit operations can have a critical impact on the collateral policy. To illustrate this, Table 1a shows a stylised balance sheet of a central bank that mainly provides liquidity through outright operations. In this case, the balance sheet size is 100, equivalent to the volume of banknotes in circulation, while on the asset side 75 is composed of a portfolio of government bonds which have been purchased outright, while 25 is composed of credit operations (i.e. also assumed to be collateralised only against government bonds).

Assume that the outstanding amount of government bonds is 200 and that these can either be owned by the central bank, the banking sector or investment funds. Given that 75 of the government bonds is held by the central bank, the remaining 125 is held by the banking and investment fund sectors. Assume that, for precautionary reasons, banks prefer to hold twice the amount of collateral which they strictly need for the credit operations, i.e. 50 of government bonds. It is well known that banks prefer to hold substantial buffers of unused collateral in case other forms of short-term market or retail funding disappear during market turbulence. Banks therefore demand 40% of the residual 125 government bonds available in the market, leaving 75, i.e. 60%, for the investment funds (see Table 1b).

In the reverse case of a central bank which mainly provides liquidity through credit operations, the size of the credit operations would be correspondingly higher at 75 and only 25 of the government bonds would be held in an outright portfolio (see Table 2a). 175 of government bonds would be held together by the banking and investment fund sector; banks would need to hold 150 (or 86%) of the 175 remaining government bonds, leaving only 25 or 14% for investment funds (see Table 2b).

In the latter case, there are more likely to be collateral constraints because banks need to hold a much larger part of the whole government bond market and have to compete more strongly with the investment fund sector (potentially bidding up the prices of the bonds and making it more costly for the banks to hold the collateral).

Table 1a Central bank balance where liquidity mainly provided through outright operations

Assets	Liabilities
Outright asset portfolio = 75 Credit operations = 25	Banknotes = 100

Table 1b Holdings of central government bonds by different sectors

Central bank	75
Banks	50
Investment funds	75

Table 2a Central bank balance where liquidity mainly provided through temporary operations

Assets	Liabilities
Outright asset portfolio = 25 Credit operations = 75	Banknotes = 100

Table 2b Holdings of central government bonds by different sectors

Central bank	25
Banks	150
Investment funds	25

Furthermore, assume that, in a time of market turbulence, there would be a further upward shift in the precautionary demand for collateral (e.g. to three times the volume of temporary operations); in this case, there would not be enough government bonds available to banks, even assuming that the investment funds were willing to sell their remaining 14% of the bonds.

This simple example shows how the size of the central bank's credit operations relative to the outright portfolio has a leverage effect on the demand for collateral, which is further amplified by banks' precautionary demand for collateral. Therefore, it can be hypothesised that, *ceteris paribus*, the smaller the size of the outright portfolio (and greater size of the temporary operations), the greater should be the size of the collateral pool to avoid the risks of shortages of collateral (in normal times and especially in times of crisis) and the bidding up of prices of the eligible bonds. If the government bond market is not sufficiently large, then the central bank needs to extend eligibility to a broader range of assets.

This has been the case for the Eurosystem, which, in the absence of an outright portfolio for monetary policy purposes, has had to operate with very large temporary operations, amounting to €466 billion, or 38% of its balance sheet, as of July 2007. This was another driving factor for accepting a broad range of collateral.

In contrast, the Federal Reserve, because of the statutory restrictions under the FRA but also due to the availability of a large supply of Treasury debt that was seen as having attractive characteristics for holding in an outright portfolio and on a permanent basis, was able to implement monetary policy with very small temporary operations. Historically temporary operations had largely been relegated to the role of fine-tuning the level of reserve supply. They amounted to only USD 23 billion or 3% of the Federal Reserve's balance sheet as of July 2007.

The Bank of England has an outright portfolio which aims to mirror to some extent the permanent structural development of banknotes in circulation. However, this outright portfolio remains relatively small (less than GBP 10 billion prior to the turmoil and an incremental increase since then), covering on average less than a quarter of the issuance of banknotes. This compares with the Federal Reserve, which covered almost all of the issuance of banknotes with its outright portfolio prior to the turmoil. The small size of the Bank of England's outright portfolio means that it still needs to conduct a relatively large volume of repo operations. This may explain why it expanded eligibility to euro area government bonds in addition to domestic government bonds.

In addition to composition, the demand for collateral is also influenced by the overall size of the central bank's balance sheet. The level of reserve requirements factors in the size of the balance sheet and the demand for collateral. In this vein, the Federal Reserve also has a much lower level of reserve requirements (USD 14 billion on average during 2007), compared with both the Bank of England (GBP 20 billion of voluntary reserves) and in particular the Eurosystem (€187 billion).

2.2.3 DIFFERENTIATING OPEN MARKET OPERATIONS FROM OTHER OPERATIONS

Another key choice by the central bank which affects collateral policy is whether it accepts the same type of collateral for its main temporary policy operations as for the standing facility and intraday credit (assuming intraday credit has to be collateralised). Credit risk in temporary operations increases with the maturity of the operations, so there is potentially a justification for a central bank to have a more restrictive list of eligible collateral for the main temporary operations (which may have a maturity from several days to several months or even longer) than for the standing facility or intraday credit (which have a maturity of one day or less). Furthermore, as the standing lending facility plays the role of an emergency source of liquidity when all other sources from the market are not available, it is natural that the range of eligible collateral should be broader than for the temporary operations.

Most large central banks, including the Eurosystem and Bank of England, maintain the same list of eligible collateral for temporary open market operations, the marginal lending facility and intraday credit, for reasons of operational efficiency. However, the Federal Reserve has a separate, more restrictive, list of eligible collateral for open market operations from that for discount window lending and intraday credit.

A single list of eligible collateral for all temporary operations can have the advantage that counterparties can pre-deposit a large pool of collateral at the central bank, which can then be used by the central bank to make loans to counterparties (at any maturity from intraday to several months) with same day settlement of the operation. An example of this operational efficiency can be seen in the case of intraday credit and the standing facility. Assume a counterparty borrows on an intraday basis from the central bank and, at the end of the day, finds that it cannot repay, for whatever reason. If the same collateral is eligible for the standing facility as for intraday credit, it is very straightforward for the central bank to extend the maturity of the loan overnight (at a penalty rate). If different collateral lists were maintained, and the collateral used for intraday credit was not eligible for the standing facility, the counterparty would need to find the required securities at short notice.

Having a single list of collateral for all operations (both monetary policy and payment system) can have a significant impact on collateral policy, primarily because payment system operations are generally large in size. Lending granted through intraday credit operations equate to more than 10% of the central bank's balance sheet for the Federal Reserve and Eurosystem, and almost 50% for the Bank of England. The large size of intraday credit operations increases the demand for collateral significantly as banks may require a large precautionary buffer of collateral to guard against unexpected large intraday payments flows. Furthermore, a central bank will normally prefer to have the broadest possible criteria for intraday credit in order to ensure that the payment system functions as smoothly as possible.

This impact is greatest in the case of the Eurosystem, where the central bank has chosen to maintain a very large pool of collateral available for intraday credit as well as a single list of collateral for all operations. In the case of the Federal Reserve, the central bank chooses not to collaterise intraday credit up to certain limits, instead monitoring counterparty credit risk using its own internal ratings. This, in conjunction with maintaining a differentiated collateral list for operations, supports a narrower collateral policy by substantially reducing the demand for collateral for temporary operations.

2.3 OVERALL IMPACT ON THE DESIGN OF THE COLLATERAL FRAMEWORK

All of the aforementioned internal and external factors have consistently worked in favour of a broad and flexible collateral framework in the case of the Eurosystem even before the current crisis, but in favour of a narrower framework in the case of the Federal Reserve and also to some extent the Bank of England.

To facilitate the implementation of its broad collateral framework, the Eurosystem defines a set of general eligibility criteria, rather than asset or issuer-specific criteria. The main criteria that applied for marketable debt securities, prior to the financial turmoil, were as follows: [16]

- denominated in euro;
- minimum credit rating of single A- from one credit rating agency;
- issued in the European Economic Area (EEA) and settled in the euro area with a

16 Some of these criteria have been temporarily relaxed during the crisis, e.g. the minimum credit rating was reduced to BBB, the eligible currencies were extended to the US dollar, yen and pound sterling, and uncovered bank bonds traded on non-regulated markets were permitted (for more details, see Chapter 3).

Central Securities Depository fulfilling the Eurosystem's minimum standards;

- issued by a entity resident in the EEA or non-EEA Group of Ten (G10) countries; and
- traded on a regulated or certain acceptable non-regulated markets.

Under this set of criteria, all types of debt instruments are potentially eligible, including not only government bonds, but also corporate bonds, uncovered bank bonds, covered bonds and asset-backed securities. Non-marketable assets, such as loans to non-financial corporations or the public sector may also be accepted as collateral. All assets must also fulfil certain requirements, such as being denominated in euro and having a minimum credit threshold. In 2007, the total amount of eligible marketable securities averaged €9.5 trillion. The average reached €11.1 trillion in 2008 with the temporary relaxation of some of the eligibility criteria. The volume of eligible non-marketable assets is currently estimated to be upwards of €0.5 trillion.

In contrast, the Federal Reserve maintains a issuer-specific approach in which it accepts only three types of securities in its temporary operations: securities issued by the central government, Federal agencies and MBSs guaranteed by the Federal agencies. In total, this amounted to approximately USD 13.5 trillion of eligible collateral at the end of 2008.[17]

Similar to the Federal Reserve, the Bank of England has also adopted an issuer specific approach and, prior to the crisis, accepted only EEA government securities rated double-A or above, US Treasuries, and other AAA-rated international financial institutions, in both its open market operations and standing facilities. However, since October 2008, it has reformed its eligibility criteria, permanently expanding the range of collateral in three-month long-term repo operations and also in its new discount window facility.

A comparison of the eligibility criteria of the three central banks before the financial turmoil is provided in Table 3.

17 This figure is higher than what is available in practice as it includes the portion that is held in the Federal Reserve's permanent portfolio.

Table 3 Cross-country comparison of eligibility criteria prior to the start of the financial market turmoil

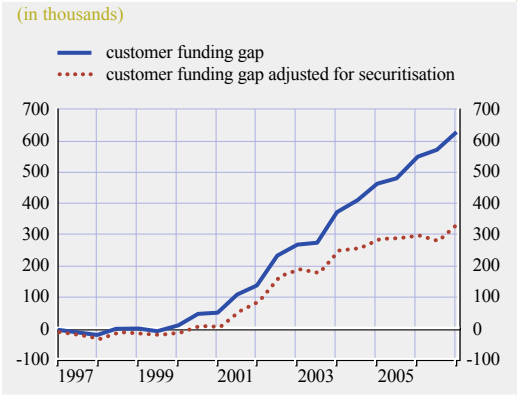
		Federal Reserve (temporary open market operations)	Federal Reserve (primary credit facility)	Eurosystem (temporary open market operations and standing facility)	Bank of England (temporary open market operations and standing facility)
Type of assets	Marketable debt securities	√	√	√	√
	Equities	-	√ Government agency stocks only	-	-
	Bank loans	-	√ Consumer, mortgage, corporate	√ Debtor must be a non-financial corporation or public-sector entity	-
Type of issuer/debtor	Central government	√	√	√	√
	Government agency	√	√	√	-
	Regional, local government	-	√	√	-
	Corporate	-	√	√	-
	Bank	-	√	√	-
	Supranational	-	√	√	√
	Asset-backed securities	√ Only if guaranteed by an agency	√ "Own use" by originator may not be permitted	√ Only if there is a true sale of assets and special purpose vehicle (SPV) is bankruptcy remote from originator	-
	Household	-	√ Residential property and consumer loans	-	-
Issuer residence	Domestic	√	√	√	√
	Foreign	-	√ Includes foreign governments, supranationals and European Pfandbrief issuers	√ For marketable securities, it includes all 30 countries of the EEA, the four non-EEA G10 countries and supranationals	√ For EEA government securities, US Treasuries and supranationals
Seniority	Senior	√	√	√	√
	Subordinated	-	-	-	-
Credit standards	Minimum credit threshold for issuer or asset	Not applicable	Minimum rating of BBB or equivalent, but AAA for some complex or foreign currency assets	Minimum single A or equivalent; asset-backed securities require AAA rating at issuance	Minimum rating of AA from at least two rating agencies
Settlement	Domestic	√	√	√	√
	Foreign	-	√ Euroclear, Clearstream and third party custodians	-	-
Currency	Domestic	√	√	√	√
	Foreign	-	√ Euro, yen, pound sterling, Swiss franc	-	√ Euro (US dollar Treasury bonds in exceptional circumstances)

3 THE IMPACT OF THE COLLATERAL FRAMEWORKS ON CENTRAL BANKS' RESPONSES TO THE TURMOIL

As discussed in the previous Chapter, the collateral frameworks of the central banks under review had been primarily designed in such a way as to protect them against incurring financial losses and to facilitate the smooth operation of monetary policy and payment system transactions. That the design of a collateral framework could also play a role in fostering the resilience of the financial system in times of market distress was probably not actively considered. However, the recent financial turmoil has brought the interaction between central banks' collateral framework, the behaviour of counterparties and secured funding markets to the fore, with structural changes in financing the cause of this heightened interaction. The trend among major global banks had been towards greater reliance on wholesale market sources of funding. Instead of relying on retail deposits, banks were increasingly relying on interbank borrowing, both unsecured and collateralised, issuance of short and long-term debt, and securitisation. This is evidenced by the increasing "customer funding gap" of the major banks – i.e. shortfall in customer deposits relative to customer lending and hence the amount of loans that needed to be financed in the wholesale markets (see Chart 1 for the UK). This "funding gap" had increased significantly before the turmoil and had been met increasingly by funding from securitisation.

This trend towards wholesale funding made access to liquidity more dependent on market conditions. As the turmoil has clearly demonstrated, sudden disruptions in market liquidity can easily cause funding liquidity problems, leading to uncertainty about bank resilience and thus triggering a vicious circle. This was certainly the case for the UK mortgage bank, Northern Rock, which had based its business model primarily on wholesale funding through the issuance of asset-backed securities. Compared with other commercial banks and mortgage banks in the UK, the share of its liabilities comprised by deposits was the one of the lowest. Northern Rock was therefore particularly vulnerable to the abrupt closure of asset-backed securities markets in the autumn of 2007, forcing it to seek emergency liquidity assistance from the Bank of England.

Chart 1 Major UK banks' customer funding gap



Source: Bank of England's *Financial Stability Report*, April 2008.

At the same time, the trend towards wholesale funding meant that the range of systemically relevant institutions had also become broader. Due to the increasing reliance on wholesale funding via both secured and unsecured markets, as opposed to the traditional deposit funding, not only traditional commercial banks but increasingly also investment banks that did not take deposits acquired systemic implications. In the traditional banking crisis literature, the focus has been on the systemic implications of a deposit run.[18] However, the recent "wholesale funding run" in both secured and unsecured markets in the case of Bear Stearns, showed that highly interconnected investment banks in their crucial broker-dealer function play a systemic role too (see Box 2 on the interaction between funding and market liquidity). Such banks perform a key role in maintaining market liquidity in a broad range of unsecured and secured markets. If they face funding liquidity constraints, market liquidity will be widely affected, with potential negative repercussions for the banking sector.

18 See Diamond and Dybvig (1983).

Box 2

FUNDING AND MARKET LIQUIDITY – DEFINITION OF CONCEPTS AND INTERACTION

The term "liquidity" has two dimensions. It can be "institution-specific", or it can be "asset-specific". "Funding liquidity" is institution-specific: it relates to the balance sheet of an individual institution.

According to the Basel Committee on Banking Supervision (BCBS), *funding liquidity* is the ability to fund increases in assets and meet obligations as they come due.[1] *Funding liquidity risk*, is "the risk that a firm, although balance-sheet solvent, cannot maintain or generate sufficient cash resources to meet its payment obligations in full as they fall due, or can only do so at materially disadvantageous terms".[2] Taking into account the increased reliance on secured funding, this relates not only to the ability efficiently to meet both expected and unexpected current and future cash flows, but also to meet collateral needs.[3]

Market liquidity is defined as "the ease with which one can liquidate a position in an asset without appreciably altering its price".[4] The correspondent risk can be defined as not being able to immediately liquidate or hedge a position at current market prices.[5]

The financial crisis has shown that financial intermediaries other than banks play a crucial role in maintaining market liquidity, and that market liquidity will be widely affected if such intermediaries face funding liquidity constraints. For example, as long as hedge funds, which might be willing to take advantage of any distortions in structured finance markets, are constrained in their investing activity because prime brokers have tightened credit availability to them, it is unlikely that structured finance markets will reopen. Brunnermeier and Pedersen acknowledge the crucial role that the market-making sector – e.g. a dealer, a hedge fund, or an investment bank – can play in maintaining market liquidity.[6] Their model shows how the funding of trades affects, and is affected by, market liquidity in a profound way due to destabilising collateral margin requirements or loss spirals that erode dealers' capital. The authors consider a simple model with trade in one security. There are three types of agents in the model. At time 1, the initial customer enters one side of the market (buy/sell), and, at time 2, the complementary customer enters the opposite side of the market (sell/buy). Dealers provide immediacy by always being willing to trade in any side of the market. They finance their securities positions via collateralised funding. Since, when they buy a security, they cannot borrow the entire price of the security by using it as collateral, due to the margin required by the lender, they need capital for trading. Hence, they face a capital constraint, determined by the margin, i.e. the difference between the security's price and its collateral value, which is in turn a function of the asset's fundamental volatility and of the market liquidity. The problem is that higher margins erode the dealers' capital so that they become more reluctant to trade with buy side firms. This in turn means that assets become less liquid, i.e. market liquidity decreases. And this means that margins increase further, tightening dealers' funding constraint further, and so on. Another liquidity spiral may emerge if dealers hold a large initial position that suffers a loss due to a negative demand shock. This can lead to a funding shock, forcing dealers to sell more, causing a further price drop, and so on.

1 Basel Committee on Banking Supervision (2008).
2 Financial Services Authority (2007).
3 See the definition of liquidity risk by the Institute of International Finance (2007).
4 See, for example, International Monetary Fund (2008), Chapter 3.
5 See, for example, Bervas (2006).
6 See Brunnermeier and Pedersen (2008).

This heightened interaction between market and funding liquidity risk has implications for the implementation of monetary policy. In order to stem a breakdown in financial market functioning, including a sudden loss of substantial amounts of secured financing, central banks have needed to find ways to extend liquidity assistance to asset markets and to relieve funding pressures not only for banks, but also for other systemically relevant financial institutions. Access to a central bank's collateralised lending facilities against a broad range of collateral can play an important role in this respect. The policy responses of the Eurosystem, Federal Reserve, and Bank of England during the turmoil are described in the following subsections.

3.1 EUROSYSTEM

As described earlier, the Eurosystem's operational and collateral framework prior to the crisis had a certain degree of inherent flexibility due to the need to cope with less developed capital markets. This meant that, despite the absence of a centralised fiscal authority, the Eurosystem did not initially have to adjust its framework to prevent an immediate meltdown of the financial system. There are three elements to this flexibility, as set out below.

Firstly, a wide range of institutions, small savings banks and co-operative banks, as well as investment banks with a limited deposit base, can access central bank liquidity directly. This feature allowed the Eurosystem to mitigate the funding liquidity risks more directly for a broader range of counterparties when short-term interbank markets stopped functioning properly.

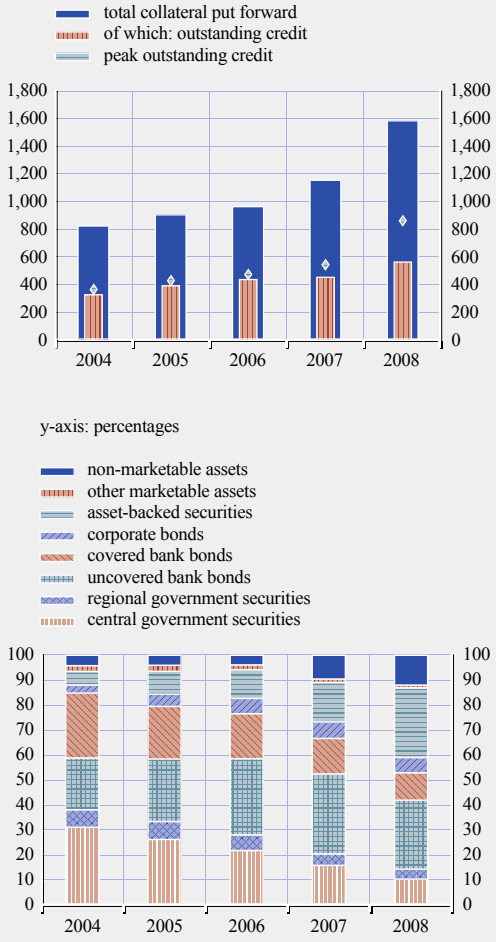
Secondly, the fact that the Eurosystem accepts a wide range of collateral in all types of credit operations meant that collateral has not been a constraint, at the aggregate level or at the level of individual counterparties. Moreover, counterparties had leeway to adjust the collateral brought forward to the central bank, in line with opportunity cost considerations. Developments in the use of collateral after the outbreak of the turmoil show that counterparties made active use of this leeway. They have economised, in particular, on the use of central government bonds, which has often been almost the only collateral counterparties could still use in interbank repo markets. By the end of 2008, €193 billion of central government bonds (equivalent to only 9% of total collateral which stood at €2.1 trillion) were pledged as collateral for Eurosystem credit operations. Thus, only 4% of the €4.1 trillion stock of government bonds was being tied up in Eurosystem credit operations, leaving the remainder to be used in private repo markets. The proportion of central government bonds in the total collateral used in Eurosystem credit operations had been on a declining trend for several years, decreasing from 21% in 2006 and 47% at the start of monetary union in 1999. At the same time, banks have increasingly brought forward less liquid collateral for which primary and secondary markets have nearly entirely dried up. Most notably, the annual average share of asset-backed securities (ABSs) pledged as collateral with the Eurosystem rose to 28% during 2008 (or €521 billion), up from 11% in 2006 and only 6% in 2004 (see Chart 2).

Finally, because the Eurosystem provides the bulk of its refinancing via temporary open market operations, these operations have also been large in scale relative to outstanding volumes in a number of market segments. For example, the size of temporary operations was more than €800 billion by the end of 2008, which was larger than the entire euro corporate bond market or equivalent to almost 50% of the entire outstanding European ABS market. The scale of the Eurosystem's operations has allowed for a large portion of these assets to be financed through the central bank.

These three features, in combination with a lengthening of the maturity profile in the regular repo operations, allowed the Eurosystem to provide liquidity assistance not only to banks but also indirectly to asset markets. As a result, the Eurosystem did not need to make many changes to its operational framework during the first year of the turmoil.

Chart 2 Volume of collateral pledged with the Eurosystem and composition of collateral

(2004-2008; annual averages; EUR billions)



Source: ECB Annual Report 2008.

This ability to provide indirect assistance to asset markets was most apparent in the ABS market. It is largely due to the Eurosystem's collateral framework that euro-denominated securitisation issuance did not come to a halt, even though the vast majority of transactions were retained on banks' balance sheets to be used in central bank credit operations. While issuance of "private label"[19] MBSs in the US declined significantly from USD 580.8 billion in 2007 to only USD 39.9 billion in 2008, in the euro area issuance actually increased from €212.2 billion in the first three quarters of 2007 to €278.2 billion in the same period of 2008. Specifically, the Eurosystem accepts only ABSs that are based on true sale and are bankruptcy-remote from the originator. Because these requirements should in principle ensure remoteness between the issuer and the originator, the Eurosystem allows counterparties use ABSs that they have originated themselves and retained on their balance sheet (so-called "own use") and counterparties have made active use of this possibility. However, as long as the Eurosystem applied variable rate tenders in its temporary operations, this did not imply that the Eurosystem refinanced the ABSs on one-to-one basis. Eurosystem NCBs generally operate so-called "pooling systems" which allow counterparties to predeposit more collateral than they actually need.[20] Indeed, these precautionary collateral buffers increased significantly during the turmoil, resulting in a large degree of over-collateralisation in the system.[21] Nonetheless, the ability to use ABSs as collateral with the Eurosystem has helped counterparties to hedge the asset refinancing risk of those instruments and possibly prevented fire sales even before the switch to fixed-rate full allotment tender procedures (see below).

19 "Private-label" MBSs refer to those securities issued by private-sector entities. There are also large volumes of MBSs issued by the US government-sponsored enterprises (GSEs), such as Freddie Mac and Fannie Mae, which are instead called "agency MBSs".

20 A "pooling" collateral system creates a pledge (or security interest) over a commercial bank's securities in favour of the central bank but, unlike a repo transaction, leaves ownership of the assets with the commercial banks. The pooling/pledge method of collateralisation is highly flexible as all assets in the bank's collateral pool are treated as fungible, and unlike the "repo" method it enables commercial banks to pledge more assets than they need to cover their borrowing. In repos, it is necessary to specify exactly which securities are being used as collateral for a loan from the central bank and "overcollateralisation" can be more complicated to organise.

21 Even during the period of fixed-rate full allotments, when banks were given the opportunity to refinance all eligible collateral, including ABSs, levels of overcollateralisation still remained very high, at around 50%. There were several reasons for the very high level of overcollateralisation. First, the opportunity cost of keeping the collateral, such as ABSs, at the central bank are extremely low or even zero (i.e. there are no alternative uses: the assets would otherwise have been idle on the banks' balance sheets). Second, banks prefer to have high precautionary buffers so that it is very quick and easy to increase borrowing levels in the event of abrupt changes in liquidity needs (e.g. due to negative publicity about the bank's credit standing).

Following Lehman Brothers filing for bankruptcy in September 2008, there was a dramatic increase in the level of dysfunction of the euro area money market, which eventually required the Eurosystem temporarily to modify its operational framework quite significantly. There were two main changes. First, starting in mid-October 2008, the Eurosystem took the unprecedented step of applying a fixed-rate full allotment tender procedure in all refinancing operations (the normal one-week main refinancing operations – MROs – and the long-term refinancing operations – LTROs) of three and six months, as well as all US dollar operations). Through this measure, the Eurosystem in effect took over the intermediation function of money markets. It removed the uncertainty for banks about their ability to finance themselves over a horizon of up to one year. Second, in order to facilitate the full allotment policy and further increase the already very broad range of eligible assets on banks' balance sheets, the Eurosystem decided temporarily to expand the list of collateral until the end of 2009.[22]

In parallel, the Eurosystem has undertaken intense work to counteract increased liquidation and concentration risks accumulating in its temporary operations by means of improved risk control measures. On 4 September 2008, the liquidity categories were technically refined, introducing higher haircuts for uncovered bank bonds and ABSs. At the same time, concentration risk for ABSs was limited by partially restricting close links between the issuer and the currency hedge or liquidity provider. Transparency for the assessment of ABSs was enhanced by the introduction of a requirement of publication of regular surveillance reports by rating agencies. All measures entered into force on 1 February 2009.

In May 2009, the Eurosystem went a step beyond trying to alleviate strains in wholesale interbank markets via temporary operations when it announced its aim to help directly improve the function and liquidity of the covered bond market, a key on-balance-sheet long-term funding tool for banks in the euro area through purchases in the primary and secondary markets. The covered bond purchase programme, which targets a nominal amount of €60 billion to be purchased between July 2009 and June 2010, aims to restore this important funding channel for banks.[23]

3.2 US FEDERAL RESERVE

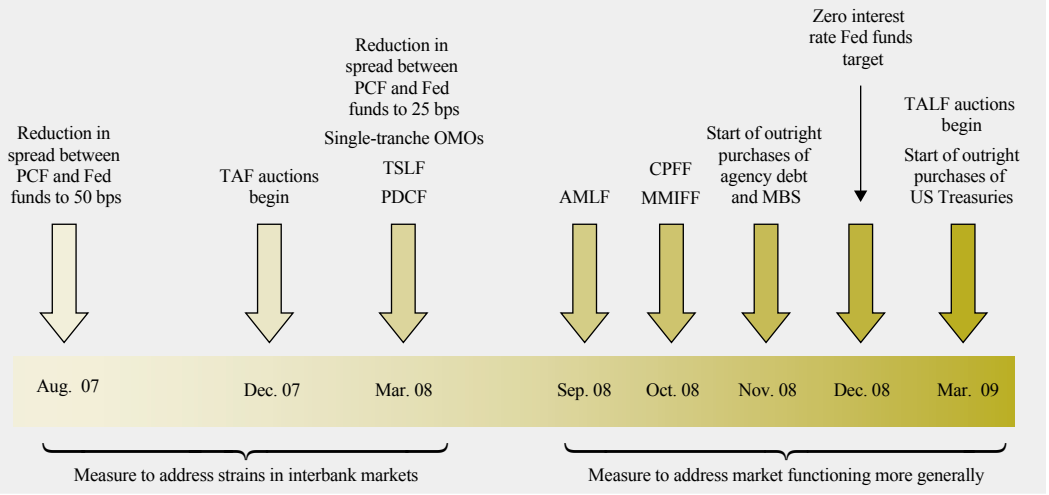
Contrary to the Eurosystem, the Federal Reserve entered the turmoil with a rather narrow operational framework in terms of eligible collateral and the range of counterparties for open market operations. The basic assumption on which the US framework rested prior to the turmoil was that markets function properly and did not require the Federal Reserve to be an active large-scale participant in financing markets on a regular basks. Coming from this starting-point, the Federal Reserve therefore needed to introduce a variety of collateralised lending programmes which effectively broadened the number and types of counterparties to which, and types of collateral against which, it extended credit. In the words of the Federal Reserve: "These actions are designed to allow financial intermediaries to finance with the central bank assets they can no longer finance as easily in the market. And in this way these liquidity facilities reduce the need for those institutions to take the types of actions, such as selling other assets into distressed markets or withdrawing credit lines extended to other financial institutions that would serve to amplify the pressures in markets".[24]

22 The temporary expansion relates to bank bonds traded on accepted non-regulated markets; subordinated debt instruments when protected by an acceptable guarantee; securities with a credit rating threshold lowered from A- to BBB-, except for ABSs; and foreign-exchange denominated collateral (yen, pound sterling, US dollar) which fulfil all the other normal eligibility criteria. In total, as a result of the measures, the increase in collateral amounted to €870 billion at the end of 2008, representing 8% of total eligible marketable collateral, while it accounted for approximately 3% of total collateral used.

23 For details see the Decision ECB/2009/16 of 2 July 2009 on the implementation of the covered bond purchase programme. On 10 August 2009, the settled amount of outright purchases conducted by the Eurosystem stood at €5.7 billion. See also the keynote address by Jean-Claude Trichet, President of the ECB, at the University of Munich, 13 July 2009.

24 Geithner (2008).

Chart 3 Timeline of measures implemented by the Federal Reserve



Source: Federal Reserve System.

A timeline summarising the measures implemented by the Federal Reserve is shown in Chart 3. The actions can broadly be divided into measures addressing strains in wholesale interbank markets (those measures in Chart 3 up to March 2008), and measures aimed at enhancing market functioning more generally (from September 2008 onwards).

These two sets of measures are described in detail in the following sub-sections.

3.2.1 MEASURES ADDRESSING STRAINS IN WHOLESALE INTERBANK MARKETS

Following the emergence of funding stresses in the interbank market in August 2007, the Federal Reserve first modified and introduced tools that were closely tied to its traditional role of providing short-term liquidity to depository institutions. The Federal Reserve modified the terms and conditions of its primary credit facility (discount window), reducing the spread between the primary credit rate and the federal funds target rate and allowing the provision of term financing, in order to provide depository institutions with greater assurance about the cost and availability of funding. Despite broad access to the primary credit facility by depository institutions, the stigma associated with the discount window restricted its effectiveness,[25] leading the Federal Reserve to create the Term Auction Facility (TAF) in December 2007. In the TAF, predetermined amounts of term financing (initially 30 days and later also 90 days) secured by the broad array of discount window collateral are auctioned to depository institutions with access to the discount window.[26] Bi-weekly auction volumes were initially set at USD 20 billion but had increased to USD 150 billion by the beginning of 2009 with total outstanding TAF operations at USD 467 billion at the end of March 2009.

In early March 2008, the Federal Reserve introduced two measures aimed specifically at primary dealers that did not have access to the TAF: (i) "single-tranche" repo operations with a term maturity of 28 days, intended to ease strains in term MBS repo markets; and (ii) the Term

25 There has traditionally been stigma attached to the use of the discount window so that depository institutions were willing to pay market interest rates above the discount window rate rather than use the discount window.

26 As for the Federal Reserve's temporary open market operations, the TAF is conducted using a uniform price auction, rather than a discriminatory auction. Counterparties submit bids (volume and rate) and the Federal Reserve accepts the bids with the highest rate first, until the allotment volume reaches the desired amount. The lowest accepted rate is known as the "stop-out" rate, and all banks pay the same stop-out rate for what they were allotted.

Securities Lending Facility (TSLF), intended to improve the functioning of the repo market by allowing primary dealers to exchange less liquid securities for Treasury securities. The single-tranche term repos could provide funding against any open market operation eligible collateral, but these operations were used predominantly to finance agency MBS debt, as it is typically more expensive to finance that Treasury and agency debt in the marketplace. The TSLF was more or less the Federal Reserve's existing government securities lending programme extended to one-month maturity and expanded beyond Treasury securities to all open market operation collateral, AAA-rated private-label ABSs and all other investment-grade securities.[27] The program addressed two problems: the availability of secured funding for primary dealers and the shortage of government securities collateral in repo markets. Because primary dealers typically have funded a very large percentage (approximately half) of their balance sheets using repo transactions,[28] they faced considerable liquidity concerns when private repo markets closed following the rescue of Bear Stearns with an emergency loan from the Federal Reserve. The TSLF enabled primary dealers to access repo markets so that they could continue to finance the large amounts of structured finance securities which they held on their balance sheet while the same time addressing the potential shortage of government securities collateral in repo markets.[29]

When disruptions in secured funding markets led to the wholesale market run on Bear Stearns, the Federal Reserve also created a standing borrowing facility for primary dealers (PDCF), akin to the primary credit facility for depository institutions, to mitigate concerns that primary dealers might be forced to sell assets into illiquid markets. The PDCF is an overnight loan facility that provides funding to primary dealers at the primary credit rate against a broad range of highly rated marketable securities (though not as broad as the discount window). Created under emergency authorisation, the PDCF arguably acknowledged the crucial role that these market makers played in maintaining liquidity.

In addition to the TAF, TSLF and PDCF, the Federal Reserve also entered into foreign exchange swaps with the ECB and the Swiss National Bank (SNB). The ECB and SNB distribute the US dollars obtained through these swaps for use in their jurisdictions. The swaps arrangements were initially conducted initially in conjunction with the bi-weekly TAF auctions, but later expanded to include other maturities and other central banks.

The expansion of credit resulting from the TAF and swap arrangements were initially offset, mostly by reducing the outright holding of Treasury securities, as a part of the interest rate targeting regime. However, after the Federal Reserve received authorisation to pay interest on depository institutions' required and excess reserve balances in October 2008, expansions in credit were no longer limited by the overall size of the Federal Reserve's balance sheet. The payment of interest was intended "to give the Federal Reserve greater scope to use its lending programmes to address conditions in credit markets while also maintaining the federal funds rate close to the target established by the FOMC".[30] The Federal Reserve also established a near-zero target range for the federal funds rate starting on 16 December 2008 in recognition that the volume of reserve balances provided through the various programmes was consistent with FOMC's funds rate objectives.

27 Initially, when the TSLF was announced in March 2008, only AAA-rated private label MBSs, commercial mortgage-backed securities and collateralised mortgage obligations (CMOs) were eligible, but the range of eligible collateral was expanded in May 2008 to include all types of AAA-rated ABSs and again in September 2008 to include all investment-grade securities (i.e. all securities rated BBB and above).

28 See Hoerdahl and King (2008) and Adrian and Shin (2008).

29 In July 1997, the outstanding amount of US Treasuries was USD 4.4 trillion, of which 2.2 trillion were held abroad, and 0.8 trillion by the Federal Reserve, leaving 1.4 trillion in the market. There is certainly a large share that is also held by passive investors which need to match long-term liabilities with long term assets. It is likely that nearly all these securities were already used as collateral in private repo markets. Thus, releasing more US Treasuries to the market through the TSLF could have helped to increase liquidity.

30 See Federal Reserve press release of 6 October 2008 (http://www.federalreserve.gov/newsevents/press/monetary/20081006a.htm).

3.2.2 MEASURES TO ADDRESS THE FUNCTIONING OF ASSET MARKETS

Growing counterparty credit concerns and intensifying strains in the commercial paper market, following the collapse of Lehman Brothers, led the Federal Reserve to introduce a second set of policy tools. The new tools were aimed at providing liquidity directly to borrowers and investors in key credit markets, in particular the commercial paper market and the ABS market.

Three separate facilities, the Asset-Backed Commercial Paper Money Market Mutual Fund Lending Facility (AMLF), the Commercial Paper Funding Facility (CPFF), and the Money Market Investor Funding Facility (MMIFF) were created to support the functioning of the commercial paper market and to ease pressures on money market mutual funds after one large money fund saw the value of its assets fall below par (which in theory should never happen as they are supposed to be very low risk investments). Specifically, the AMLF aimed to help money market mutual funds to meet redemptions of asset-backed commercial paper (ABCP) by providing funding to US depository institutions to finance purchases of high-quality ABCP from money funds. The MMIFF was designed to support a private-sector initiative to provide liquidity to money market investors by facilitating the sale of money market instruments in the secondary market.

Unlike the MMIFF, which did not involve any borrowing, the CPFF, which buys high-quality commercial paper at a term of three months, was heavily subscribed. The commercial paper market was under considerable strain, with corporate borrowers finding financing difficult to obtain, and then only at high rates and very short (usually overnight) maturities. The CPFF therefore acted as a liquidity backstop, so as to reduce concerns about "rollover risk", i.e. the risk that a borrower could not raise new funds to repay maturing commercial paper. By reducing rollover risk, the CPFF helped increase the willingness of private investors to lend, particularly for terms longer than overnight. Eligible assets included US-dollar denominated commercial paper and ABCP, issued by US companies, with a rating of at least A-1/P-1/F1.[31] In effect, the Federal Reserve provided short-term unsecured loans directly to companies and other financial intermediaries, bypassing the normal role of the commercial paper market. The CPFF became operational at the end of October 2008 and is credited with having improved the functioning of the commercial paper market, as rates and risk spreads have come down and the average maturities of issuance have increased.

In addition to the problems affecting the commercial paper market, new issuance of term ABSs also declined precipitously in September 2008 and came to a halt in October of 2008. At the same time, interest rate spreads on AAA-rated tranches of ABSs soared to levels well outside the range of historical experience, reflecting not only deteriorating fundamentals but also unusually high risk premiums. The ABS markets had historically funded a substantial share of consumer credit and Small Business Administration-guaranteed small business loans, and there were concerns that continued disruption of these markets could significantly limit the availability of credit to households and small businesses and thereby contribute to a further weakening of economic activity.

In order to facilitate renewed issuance of consumer and small business ABSs at more normal interest rate spreads, in November 2008 the Federal Reserve, in cooperation with the US Treasury, which provided capital, announced the Term Asset-Backed Securities Loan Facility (TALF) to provide three-year term loans on a non-recourse basis to holders of certain AAA-rated ABSs backed by wide

31 Limits were placed on the amount that could be purchased for each issuer, based on average outstanding issuance in the period 1 January to 30 August 2008. If an issuer did not issue commercial paper in this period, it was not eligible to access the facility. Borrowing from the facility could be made whenever required, like a standing facility. The interest rate and fees charged on the loans were 100 basis points above the three-month overnight indexed swap (OIS) rate plus an additional fee of 100 basis points if no collateral was provided.

range of asset classes, in particular consumer and small business recently-originated debt. By only accepting ABSs backed by "new" loans, the Federal Reserve intended to provide an incentive to revive private lending. This was in contrast to the Bank of England's Special Liquidity Scheme (see sub-section 3.3) that only accepted ABSs backed by "old" loans, and which aimed to remove the stock overhang but not to stimulate new lending.

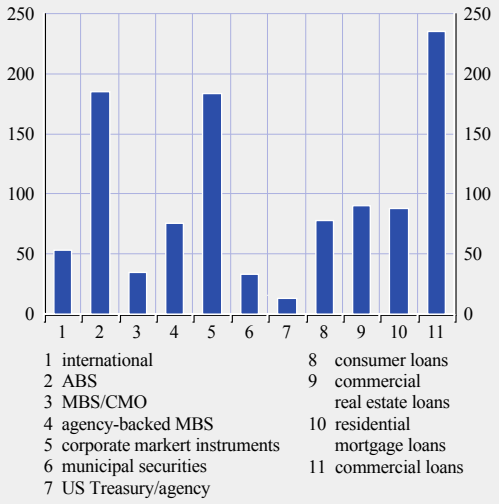
A key feature of TALF loans is that they are not subject to mark-to-market or re-margining and, as the loan is non-recourse, if the borrower does not repay the loan, the New York Federal Reserve will enforce its rights over the collateral and sell the collateral to a SPV established specifically for the purpose of managing such assets. The non-recourse nature of the loan enables investors to write off the exposure if asset prices deteriorate sufficiently, thereby limiting their exposure and providing a quasi-guarantee. This provision of liquidity combined with a capital guarantee was therefore intended to provide an incentive for a broader range of investors to purchase ABSs in the primary market, despite high levels of risk aversion and the need to deleverage.

However, the first monthly auction in March 2009 yielded less than USD 5 billion of demand for loans, reflecting the logistical challenges in structuring these complex deals. Since then, volumes were USD 10 billion in May and USD 11.5 billion in June, falling back to USD 5.4 billion in July, while spreads in both primary and secondary market have tightened.

The composition of collateral pledged to the various lending facilities of the Federal Reserve shows that over half of the collateral is comprised of loans to corporations, loans for residential house purchases and consumer loans (see Chart 4). This is a much higher share than for the Eurosystem, which is particularly noteworthy given that the US financial system is far less bank-based than the Eurosystem's. It is due to the more liberal eligibility criteria for loans under the US framework, in particular the eligibility of consumer and residential loans.

Chart 4 Collateral pledged to Federal Reserve lending facilities

(as of August 2009; USD billion)



Source: Federal Reserve System.
Monthly Report on Credit and Liquidity Programmes and the Balance Sheet.

The other main source of collateral for the Federal Reserve is private-label ABSs/MBSs and government agency MBSs. Overall, USD 2.1 trillion of collateral was pledged to the Federal Reserve, an amount comparable to that pledged to the Eurosystem.

In conjunction with the TALF programme, the Federal Reserve also announced a programme to purchase up to USD 100 billion of direct obligations of housing-related GSEs (Fannie Mae, Freddie and the Federal Home Loan Banks) and up to USD 500 billion of MBSs backed by Fannie Mae, Freddie Mac, and Ginnie Mae. On 18 March 2009, purchases of longer-term Treasury securities of up to USD 300 billion were added to the program and the size of the programme for direct obligations of GSEs and MBSs was increased to USD 200 billion and USD 1.25 trillion respectively.[32]

32 See Federal Reserve press release on 25 November 2008 (http://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm) and FOMC statement on 18 March 2009 (http://www.federalreserve.gov/newsevents/press/monetary/20090318a.htm) for details.

These purchases were intended to provide support to mortgage lending and housing markets and to improve conditions in private credit and financial markets.[33] By 29 July 2009, the Federal Reserve had purchased USD 229 billion, USD 107 billion, and USD 543 billion in Treasuries, GSE direct obligations and MBSs respectively.[34]

3.3 BANK OF ENGLAND

The Bank of England had traditionally only accepted highly liquid government bonds as collateral in its regular open market operations and its standing facilities. Under this collateral framework, banks could not refinance assets which had become illiquid, even at penal rates, at the central bank. The Bank of England thought it necessary to weigh the case for lending against illiquid collateral (to relieve pressure in the money market) against the moral hazard created by providing ex post insurance for risky behaviour.

However, following the severe liquidity problems which emerged in September 2007 at Northern Rock, it was clear that there were contagion effects affecting the whole banking system and that the central bank needed to address a systemic liquidity problem. The Bank of England therefore decided to relax its stance, and expanded its range of eligible collateral. It first announced that it would offer term repo auctions for funds of three-month maturity against a wider than usual range of collateral (not only government bonds but also for the first time private sector securities, AAA-rated residential mortgage backed-securities (RMBSs), non-securitised prime mortgages, etc.), but subject to a interest rate floor of 100 basis points above the Bank Rate (i.e. at the existing standing facility rate[35]) regardless of the quality of the collateral. The facility was in effect acting as a temporary substitute discount window facility. Four term auctions against extended collateral were held in September and October 2007, but no bids were received from commercial banks, reportedly because they feared that their borrowing from this liquidity facility would become public, and then lead to a similar fate as befell Northern Rock (i.e. the same stigma effect that caused problems for the Federal Reserve's primary credit facility in the early stages of the crisis).

Towards the end of 2007, tensions in money markets had grown significantly. In order to address these tensions, the Bank of England announced that it would conduct two special three-month longer-term repo operations against a wider pool of collateral. The extended collateral pool included AAA-rated RMBSs and ABS-backed by credit card receivables, AAA-rated US GSE debt, and AAA covered bonds. The use of "own issued" RMBSs/ABSs was permitted and assets could be denominated in most major currencies. Only the normal range of open market operation counterparties was allowed to participate, however, not the full range of standing facility counterparties. This time banks did participate and both operations were fully allotted. It seems that, because the operation was conducted according to the normal, albeit modified, longer-term operation, the threat of stigma had been reduced. The extended collateral long-term repo auctions were temporarily reinitiated in March 2008, because of increased money market tensions following the near-collapse of Bear Stearns and again following the bankruptcy of Lehman Brothers in September 2008. The list of eligible collateral was expanded several times in October 2008 to accept a slightly broader range of securities (now also including AAA-rated ABSs of corporate and consumer loans, some types of ABCP, and the newly-issued bank bonds covered by the central government's guarantee scheme).[36]

33 The Federal Reserve's MBS purchase programme includes the support of the MBS security dollar roll market. Dollar roll transactions consist of a purchase of securities combined with an agreement to sell securities in the future and provide short-term financing to the MBS market.

34 While the purchases of Treasuries and GSE direct obligations were conducted through competitive auction with the primary dealers, purchases of MBSs were conducted through external investment managers due to the size and complexity of the MBS programme.

35 A high interest rate was demanded on the funds as the central bank continued to consider it important to penalise those banks which had imprudently managed their asset and liquidity mix.

36 Following the extension of the range of eligible collateral in October 2008, there were also changes to the minimum bid rate in the auctions. For the previously eligible extended collateral, the minimum bid rate remained at the OIS rate as in previous auctions, but for bids against the further extended collateral pool, the minimum bid rate was set at 50 basis points higher than the equivalent maturity OIS rate.

In April 2008 the Bank of England also introduced a Special Liquidity Scheme (SLS) to tackle the overhang of illiquid securities on banks' balance sheets as a consequence of the ongoing dislocation in securitisation markets. The SLS addressed the fact that secured wholesale markets, upon which banks had become increasingly reliant for funding in the preceding years, were now closed. Under the scheme, the central bank was in effect conducting a type of securities lending operation, lending Treasury bills to commercial banks on a temporary basis collateralised by a similar, although slightly more restrictive, range of assets eligible in the central bank's extended collateral long-term repos. The banks were also allowed to use "own name" securitisation, albeit with an additional haircut. One of the key advantages of the SLS compared with the extended collateral long-term repos was that it enabled the central bank to liquefy a much larger volume of the assets of the banking system, while at the same time not increasing the level of banks' reserves at the central bank; thus it did not have any monetary policy impact (which would then have needed to be counteracted).

The SLS has many similarities to the TSLF introduced by the Federal Reserve one month earlier, but there were also several differences. For example, the maturity of the SLS loans was significantly longer and, as mentioned above, the eligible collateral in the SLS was limited to "old mortgages".[37] The SLS also achieved a similar effect to the collateral regime of the Eurosystem, but again there are a number of key differences. First, and most importantly, the scheme is a one-off operation with a finite life, while for the Eurosystem the ability to swap illiquid assets for central bank money is a permanent feature of its framework. Therefore, under the SLS, banks could have a greater incentive to structure transactions with a view to placing them later with third party investors, while the Eurosystem may be left with ABS collateral which may not satisfy third-party investor requirements. Second, unlike the SLS, in the Eurosystem collateral framework there are very few restrictions on the type of underlying assets backing the ABS collateral, in particular no requirement that the ABS must be backed by "old" mortgages.

Given the long-term nature of the SLS, a pricing method was chosen so that there would be an incentive for banks to unwind their asset swaps as soon as markets returned to more normal conditions. The price of the swap was the spread between the three-month unsecured LIBOR rate and same maturity General Collateral (GC) repo rate. Assuming banks use the government bonds they obtain in the swap to obtain cash in the repo market, they are in effect taking a collateralised loan from the Bank of England but are paying the unsecured interbank rate. When repo markets for MBSs opened again, the repo rates for this collateral would likely be below the unsecured LIBOR rate, providing an incentive for commercial banks to redeem the swaps. The size of the SLS was initially planned to be GBP 50 billion, but total lending by the time the scheme closed in January 2009[38] reach GBP 185 billion due to heavy demand from counterparties.[39] The collateral consisted mostly of RMBSs and mortgage covered bonds, a large proportion of which was "own name" bonds.

Both of these measures – extended collateral repos and the SLS – were considered to be merely as temporary operations. But, acknowledging the need to make its collateral framework flexible enough to cope

37 Securities used as collateral in the SLS had to be backed by "old" mortgages, i.e. mortgages that had been concluded before the end of 2007. The facility was intended to solve a "stock overhang" problem on banks' balance sheets but not to encourage the banks to engage in new mortgage lending using the same kind of RMBSs that had become illiquid. In the TSLF, there was no restriction on the age on the mortgages included in the mortgage-backed securities.

38 The SLS drawdown period was initially planned to last only six months, ending on 21 October 2008, but due to the unforeseen severe market tensions in October, the SLS closing date was later extended by another three months to 30 January 2009. With the introduction of the newly-functioning Discount Window Facility, which also enabled a swap of government bonds for mortgage-backed and other collateral, the SLS was therefore deemed no longer to be necessary.

39 32 counterparties accessed the scheme.

with stressed conditions, the Bank proposed, in October 2008, to undertake a more long-term revamp of its operational framework. First, it proposed to make the extended collateral LTROs a permanent feature of the framework, but with a number of modifications to the auction format to ensure that banks pay a rate commensurate with the liquidity risk of the collateral. Second, it proposed to introduce discount window facility (DWF) open to all counterparties with access to the existing standing facilities but against a much broader range of collateral.[40] Contrary to normal standing facilities, the central bank lends government bonds instead of cash against eligible collateral (although cash lending might be possible in exceptional circumstances). Under normal circumstances, it was envisaged that the term of the transaction would be 30 days, although the term was temporary extended to one year during the crisis at an incremental fee.

The DWF aims to solve several problems. First, commercial banks can use it at any time, not just on the day of the auction, as was the case for the extended collateral long-term repos. It therefore provides banks with a more reliable and immediately accessible form of liquidity insurance. Second, the disclosure of information on the use of the DWF has been delayed and limited, thereby hopefully reducing the stigma associated with it, as it would be more difficult to identify the commercial banks which used it.[41] Third, unlike the long-term repos, the DWF will not impact on liquidity conditions as the central bank normally would not lend cash, but government securities (similar to the construction of the SLS). Fourth, the DWF aims to solve what the Bank of England has termed the "time-inconsistency" problem in ensuring financial stability, and thus avoid creating moral hazard.[42]

As part of its most recent set of turmoil measures, the Bank of England also started to support asset markets directly via outright operations. In January 2009, the Bank of England established the Asset Purchase Facility (APF) with the initial objective of improving the functioning of corporate debt markets. The intention was for the Bank of England to use the facility to purchase high-quality private sector assets which would be financed by the issuance of Treasury bills. On 5 March the Bank of England announced that the APF would also be used as a monetary policy tool to purchase assets financed by the issuance of central bank reserves. The purpose of these asset purchases was to increase "the supply of money in the economy, ease conditions

40 The collateral eligible for the Bank of England's DWF is significantly broader than for the SLS and extended collateral long-term repos, but it is still narrower than for both the Federal Reserve's discount window and TAF operations, as well as the Eurosystem's euro credit operations (both the main open market operations and standing facilities). Eligible collateral for the DWF is classified in four different categories depending on the liquidity and credit quality of the securities: *Level A collateral* consists of high-quality debt securities that are routinely eligible as collateral in the Bank's short-term repo Open Market Operations and Operational Standing Lending Facility, as published on the Bank's website; *Level B collateral* consists of third-party debt securities that are, in the Bank's judgment, trading in liquid markets; *Level C collateral* consists of other third-party debt securities, including those that are not trading in liquid markets in the Bank's judgment; *Level D collateral* consists of own-name securitisations and own-name covered bonds. All covered bonds and structured finance securities must have been rated AAA-rating at issue, and thereafter must be rated at least A-. All corporate bonds must currently be rated at least single-A.

41 The central bank will only publish the aggregate average daily value of government securities lent under the DWF four times a year, at the end of each quarter.

42 If the central bank specifies in advance a list of high-quality collateral against which it will lend, the banking system knows that those assets are liquid in all circumstances and therefore has an incentive to hold them. But if a bank gets into trouble and still faces a liquidity problem after using all its central bank-eligible assets, the authorities face a choice between letting it fail or lending against a still wider class of assets. Their choice will turn on an assessment of the trade-off between the risk of financial instability today and financial instability tomorrow: possibly today if the firm's failure would have undesirable spillovers to other firms and markets; but tomorrow if the firm is salvaged and incentives for prudent risk management are diluted. If a bank judges that its own failure is very likely to cause widespread systemic distress, it is likely to believe that the central bank's collateral policy will be relaxed and so choose to hold less of the highest quality eligible assets than otherwise (since they carry a lower yield than other assets). In those circumstances, the central bank may not be able to adhere to its collateral policy (i.e. time inconsistency). For further details, refer to a speech by Bank of England Deputy Governor Paul Tucker "The Structure of Regulation: Lessons from the Crisis of 2007", at the LSE Financial Markets Group conference on 3 March 2008 (published on 25 November 2008).

in corporate credit markets and ultimately, to raise the rate of growth of nominal demand to ensure inflation meets" the inflation target of 2% in the medium term. The size of the APF has been increased twice and stood at GBP 175 billion at the end of July 2009.[43]

By 30 June 2009, the Bank of England has purchased GBP 2 billion and GBP 0.8 billion in commercial paper and corporate bonds respectively, as a part of the APF. Additionally, on 30 July 2009, the Bank of England announced plans to buy ABCP in the primary and secondary market the Secured Commercial Paper facility as a part of the APF. It is intended that the latter facility should operate for as long as "highly abnormal conditions" persist in the corporate credit markets. The Bank of England had purchased GBP 96 billion in gilts by 30 June 2009.[44]

43 See BoE Market Notice Asset Purchase Facility (http://www.bankofengland.co.uk/publications/news/2009/009.htm), announcement of GBP 75 billion Asset Purchase Programme (http://www.bankofengland.co.uk/publications/news/2009/019.htm), announcement of GBP 125 billion Asset Purchase Programme (http://www.bankofengland.co.uk/publications/news/2009/037.htm), announcement of GBP 175 billion Asset Purchase Programme (http://www.bankofengland.co.uk/publications/news/2009/063.htm), news release: Secured Commercial Paper (http://www.bankofengland.co.uk/publications/news/2009/062.htm), Asset Purchase Facility Quarterly Report 2009 Q2 (http://www.bankofengland.co.uk/publications/other/markets/apf/quarterlyreport.htm).

44 See Bank of England Quarterly Bulletin 2009 Q2 (http://www.bankofengland.co.uk/publications/quarterlybulletin/m09.htm).

4 COMPARISON OF THE CENTRAL BANKS' RESPONSES TO THE CRISIS

This chapter compares the different responses of the three central banks to the financial market turmoil, focusing in particular on how accommodative they have been in alleviating strains in wholesale interbank markets and dislocated asset markets by means of temporary operations, or in other words how much "insurance" did the central bank provide. The assessment of what level of "insurance" the central banks provided is conducted based on a number of indicators, such as the range of collateral, the range of counterparties, the size of operations and the interest rate charged.

4.1 CRITERIA FOR MEASURING THE LEVEL OF LIQUIDITY INSURANCE PROVIDED BY CENTRAL BANKS

The "accommodativeness" of a central bank's operational framework – and hence the level of liquidity insurance – can be measured co-jointly by five key factors relating to the design of the operational and collateral framework.

(i) *The range of eligible counterparties*: The broader the range of counterparties with access to the central bank's liquidity-providing operations, the broader the provision of funding liquidity risk insurance to the banking systen as a whole. If a bank has no access to central bank funding, then it has no insurance. Because a bank may be more willing to transact with a central bank open maket operation counterparty than a non-central bank counterparty, there may also be positive network externalities from having more eligible counterparties, as it increases certainty in the system as a whole that liquidity risk can be hedged, and therefore generates greater liquidity in the interbank market.

(ii) *The interst rate*: The level of liquidity insurance is also dependent on the interest rate charged on the loan, i.e. whether banks can only borrow large amounts at at a "penal" rate or also at more "market" rates.

(iii) *Size of the operations*: The larger the size of a central bank's temporary open market operations relative to the aggregate short-term liabilities of the banking sector, the higher the level of liquidity insurance. If the open market operations are relatively large (i.e. few supply constraints), it would be possible for a bank (or group of banks) under stress significantly to increase their borrowing from the central bank (substituting their borrowing from the market), without absorbing the whole allotment of funds and/or paying very high interest rates. If, in contrast, the open market operation supply is relatively small, banks have relatively little flexibility to increase their borrowing without meeting constraints, e.g. on allotment size or the level of rates. It is also likely that if the allotment size is relatively small, central banks will wish to apply limits to prevent a single counterparty from obtaining the whole allotment (and thus being in a position to manipulate the market).

(iv) *Range of eligible collateral*: The broader the range of eligible collateral, the higher the level of liquidity insurance. Commercial banks, in their stress testing and contingency planning for liquidity risk, explicitly take into account whether assets can ultimately be pledged as collateral in central bank operations (both open market operations and standing facilities). According to a report on liquidity risk management by the Institute of International Finance, "firms should maintain a cushion of eligible central bank or highly liquid assets to generate liquidity through repos, through asset sales or through central bank pledges".[45] Thus, even if an asset is fundamentally highly illiquid in the market, but is nevertheless eligible for central bank operations, it might

45 Institute of International Finance (2007).

become, depending on national liquidity regulations, a "highly liquid asset" for a bank in the context of managing liquidity risk. A central bank plays a role in equalising the liquidity risk of all assets that it accepts as collateral, and the broader the range of collateral that a central bank accepts under normal conditions, the greater the equalisation effect across asset classes. Of course, a central bank cannot equalise the liquidity risk completely, as it only accepts such assets on a repo (rather than outright) basis, in only relatively short maturities, and in limited, albeit sometime large, amounts. Only if a central bank were willing to buy outright, in unlimited amounts and at market prices would liquidity risk be completely equalised between different assets.

(v) *Term of the operations*: The longer the term or maturity of the operations, the higher the level of liquidity risk insurance. Clearly if banks had to roll over their central bank borrowing on a daily basis, it would create uncertainty and a risk for the bank that it might not be able to obtain sufficient liquidity on a certain day. The longer the term, the greater the ability of the bank to plan how to fund itself and mitigate unexpected cash outflows. One of the first ways that central banks mitigated funding liquidity risk during the financial turmoil was by extending the maturity profile of their normal operations.

Using these five criteria, the highest possible level of liquidity insurance that the central bank could hypothetically provide would involve a combination of the following measures:

- All banks are eligible to participate in central bank operations;
- Unlimited liquidity provision or absorption;
- Zero width of standing facility corridor of interest rates, i.e. deposit facility and marginal lending facility are the same rate;
- Acceptance of any type of collateral (with no haircuts applied and pricing according to the market)[46]; and
- Unlimited maturity of borrowing.

4.2 APPLICATION OF THE CRITERIA TO THE EUROSYSTEM AND US FEDERAL RESERVE

Table 4 summarises these criteria for the various Federal Reserve and Eurosystem operations, as of 1 April and 29 July 2009 respectively.

The Federal Reserve's discount window lending facilities (i.e. the TAF and the PCF, which was modified to also provide term lending) are clearly the most comparable with the Eurosystem's full allotment operations. In fact, the Federal Reserve's PDCF, TSLF and TAF programmes, as well as the Bank of England's SLS, DWF and long-term repo operations, can be classified as "subsets" of the Eurosystem full allotment temporary operations.

Based on the aforementioned criteria for comparing the extent of liquidity provision to the banking sector, the Federal Reserve's discount window operations could, at least at first sight, be perceived as more accommodative than the Eurosystem repo operations for the reasons set out below.

– The range of collateral eligible for the TAF/PCF is broader. In addition to collateral that is eligible in the Eurosystem, it also includes unsecuritised residential mortgage loans and consumer credit loans. Although private-label ABSs are accepted as collateral for the TAF/PCF, it is unclear whether "own use" of ABSs by the originator is allowed for TAF/PCF (as is the case in the Eurosystem).

– The range of eligible counterparties for the Federal Reserve is also broader with all 7,000 depository institutions potentially

46 It could even be assumed that the central bank supplies uncollateralised funds.

Table 4 Comparison of extent of liquidity provision via temporary operations of Federal Reserve and Eurosystem post-crisis frameworks

	Range of collateral	Size of operation	Total programme size	Potential range of counterparties	Interest rate charged on loan relative to the policy rate
Eurosystem					
Main/longer-term refinancing operations	- All types of marketable securities rated investment grade or above - "Own use" of ABSs and covered bonds - Non-marketable loans to corporations or public sector	1 April 2009: €660 billion 29 July 2009: €797 billion	Unlimited, as long as enough collateral	ca. 2,200 depository institutions	Fund supplied at policy rate (but any excess must be placed on deposit facility at policy rate minus 75 basis points)
Marginal lending facility	Same as above	1 April 2009: €1 billion 29 July 2009: €0.2 billion	Unlimited, as long as enough collateral	ca. 2,300 depository institutions	Policy rate + 100 basis points
Federal Reserve					
Term Auction Facility (TAF)	Very similar to Eurosystem *plus* credit card loans, mortgage loans	1 April 2009: USD 467 billion 29 July 2009: USD 238 billion	USD 600 billion, but most likely the programme size would be increased if demand increased. Currently it is undersubscribed	ca. 7,000 depository institutions	Funds generally supplied at policy rate; excess reserves also remunerated at policy rate
Primary Credit Facility (PCF)[1)]	Very similar to Eurosystem *plus* credit card loans, mortgage loans	1 April 2009: USD 58 billion 29 July 2009: USD 36 billion	Unlimited, long as enough collateral	ca. 7,000 depository institutions	Policy rate +25 basis points; excess reserves are remunerated at the policy rate
Term Securities Lending Facility (TSLF)	All marketable securities rated investment grade and above	1 April 2009: USD 86 billion 29 July 2009: USD 3 billion	USD 200 billion	18 primary dealers	10-25 basis points, depending on collateral
Primary Dealer Credit Facility (PDCF)	All marketable securities rated investment grade and above	1 April 2009: USD 18 billion 29 July 2009: USD 0 billion	Unlimited, but not for systematic use	18 primary dealers	Policy rate + 25 basis points

1) The PCF underwent several changes during the period of the turmoil and the conditions of use (i.e. counterparties, collateral, maturity), except for the interest rate (which in recent auctions has been around 0.25% higher) are now identical. Since the autumn of 2008, it seems that the stigma of using the PCF has been resolved and the lower use of the PCF relative to the TAF is entirely the result of the TAF having become less expensive, as the programme size was increased to USD 600 billion and it began to be undersubscribed.

able to access the TAF/PCF.[47] For the Eurosystem, only a subset (2,200 of the 6,500) of credit institutions can bid in the MROs/LTROs.[48] Having said this, the number of banks which regularly bid in the Eurosystem operations has been significantly higher than in the Federal Reserve's TAF auctions.

– The interest rate for the TAF/PCF is lower. Currently, US banks can obtain funds in the TAF at the Fed's policy rate (as the operations have undersubscribed due to the size of the programme) and the PCF rate is 25 basis points above the policy rate. In comparison, Eurosystem banks can also borrow at the policy rate but in the marginal lending facility (which only provides for overnight borrowing) the rate charged is currently 75 basis points above the policy rate. And while banks in the US earn the policy rate on excess liquidity held above requirements, Eurosystem banks only receive the remuneration of the deposit facility (i.e. 75 basis points below the policy rate).

– In terms of the size of the operations, the TAF was in theory restricted to a maximum amount of USD 600 billion,[49] while in the Eurosystem there is no limit. But given that the current TAF volume is USD 133 billion below its maximum limit, it does not appear to be a constraint (see chart 5). It is furthermore not excluded that if demand in the TAF were ever to increase to the maximum the Fed would quickly expand the programme size. Furthermore, there is no limit for the PCF.

Overall, the actual amount of credit provided by the Fed's TAF/PCF and under the Eurosystem full-allotment operations was similar during the first half of 2009. On 1 April 2009, the Eurosystem provided €660 billion compared with the Fed's USD 525 billion. Including the liquidity provided to the primary broker dealers through the PDCF and TSLF,[50] which are both

47 Although the primary broker dealers (such as Cantor Fitzgerald) cannot use the TAF/PCF, all of the bank holding companies with investment banking arms can participate, e.g. Citigroup, JP Morgan Chase, Merrill Lynch/Bank of America, Goldman Sachs, etc.

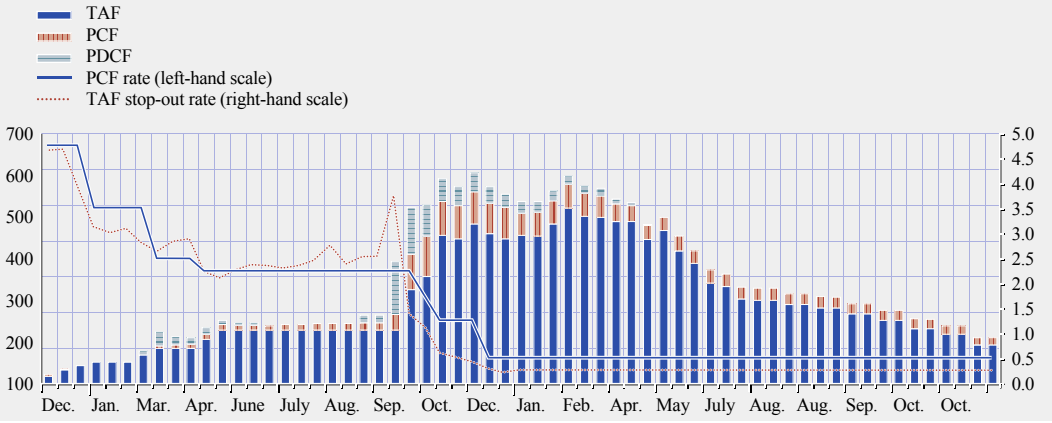
48 For both the Federal Reserve and the ECB, banks may not have access to the central bank's operations if they have decided not to fulfil the limited, operational prerequisites to participate.

49 The size of individual TAF operations was reduced from USD 150 billion to USD 100 billion during July and August of 2009, with the Federal Reserve indicating that it could continue to trim the size of TAF offerings. Although the size of the operations has fallen, supply remains higher than demand.

50 Although the TSLF is only an asset swap operation rather than a liquidity-providing operation, it can be confidently assumed that the counterparties will ultimately use government bonds in private repo operations to obtain funding.

Chart 5 Use of the Term Auction Facility, Primary Credit Facility and Primary Dealer Credit Facility

(December 2007 to November 2009; left-hand scale in USD billion; right-hand scale in percentage)



Source: Federal Reserve System.

more restrictive in terms of collateral than the discount window-related operations, the amount of credit extended by the Federal Reserve would be USD 629 billion, close to the level provided by the Eurosystem.

Furthermore, two of the Federal Reserve's programmes, CPFF and TALF, go beyond the scope of the Eurosystem's measures. The CPFF facilitates direct purchases of commercial paper from issuers. While the Eurosystem's framework and policies do not directly support the purchase of commercial paper in the primary market, the Eurosystem facilitates purchases indirectly by allowing banks to act as intermediaries in the purchase of commercial paper which is then refinanced at the central bank.[51] The TALF programme goes much further the Eurosystem's measures as it involves a non-recourse loan to investors, and thus represents a quasi-outright purchase of securities in an effort to revive the ABS market.

However, the way in which liquidity is provided to counterparties in the two operational frameworks has started to diverge again since the introduction of the one-year LTRO by the Eurosystem and the winding-down of the lending facilities of the Federal Reserve in the wake of improved market conditions and the rapid expansion of the outright portfolio. On 29 July 2009, the Eurosystem provided €797 billion through its full allotment operations, while the amount of credit extended by the Federal Reserve via comparable operations was only USD 278 billion.

4.3 SPECIAL FEATURES OF THE EUROSYSTEM OPERATIONAL FRAMEWORK

There are also a number of special nuances of the Eurosystem temporary operations which distinguish them from the Federal Reserve's discount window lending.

- First, only depository institutions are able to access to the TAF. Primary dealers were instead given access to the PDCF and TSLF, both of which were more restrictive. The PDCF has restrictions on over-usage while the TSLF has a programme size limit of USD 200 billion. Hence, for primary dealers the Federal Reserve's framework is more restrictive.

- Second, Eurosystem refinancing operations are available at a longer maturity. While TAF and PCF made funds available out to three months' maturity, operations in the Eurosystem go up to 12 months.

- Third, due to the high level of transparency regarding the eligibility criteria, banks and issuers in the Eurosystem know in advance that their bonds will become eligible. The Eurosystem facilitates banks' collateral and liquidity management by publishing a list of all eligible assets (more than 45,000 individual securities) on its website, updated on a daily basis. In comparison, the Federal Reserve maintains a higher level of discretion regarding eligibility criteria and does not publish a daily list of eligible collateral. In order to use an asset as collateral, the bank must submit it for an eligibility check.

- Fourth, the ability to use "own use" ABS as collateral allowed Eurosystem counterparties to mitigate their funding liquidity risk effectively when ABS markets closed up. At the same time, this "own use" has been a source of high risk for the Eurosystem, and, going forward, is complicating the task of getting the euro-denominated ABS market to function properly again. The Federal Reserve does not allow "own use" of ABSs as collateral in its TAF and PCF operations.

It is also crucial to be aware that many of the policy measures the Federal Reserve created in the wake of the turmoil will unwind automatically as market conditions improve. Most of the collateralised lending facilities should run off in the natural course of business

51 This assumption is supported by the fact that, since the crisis began, the use of commercial paper and certificates of deposit as collateral in Eurosystem operations has increased significantly

as financial market conditions recover, as the programmes are priced at a premium over normal interest rate spreads. In fact, a number of programmes are already in this process. Overall the sum of TAF, PCF, PDCF and TSLF fell from its peak of USD 775 billion in December 2008 to USD 274 billion at the end of July 2009. Also, the Federal Reserve is currently authorised to extend credit through PDCF, AMLF and CPFF only until 1 February 2010.

Furthermore, the relaxation of collateral standards in discretionary operations and the expanded scale of term financing by the Federal Reserve (and also in the case of the Bank of England's SLS) are of a temporary nature, while the broad range of collateral and large temporary operations in the Eurosystem are a permanent feature of its framework.

4.4 COMPARISON OF THE PERFORMANCE OF THE COLLATERAL FRAMEWORKS

Although it is difficult to evaluate which framework has performed better overall during the course of the turmoil, particularly given the changes made to central banks' operational frameworks, a number of useful observations can be made. The Eurosystem adjusted its framework much less than the Federal Reserve and Bank of England. To a large extent, the magnitude of changes to the operational framework for each central bank has depended on the extent to which countries have been hit by the crisis. In this respect, the US and UK were arguably more affected, at least initially, than the euro area. More importantly, the flexibility of the Eurosystem's framework was to a large extent a function of historical necessity since euro area banking structures were far from homogeneous across Member States and the extent to which the financing system has developed from a more bank-based towards a more market-based financing system differed across Member States. Additionally, fixed income markets, including the government bond market, remain not yet fully integrated. As such, the Eurosystem's collateral framework has been forced to cater for these structural financial differences. Furthermore, the latest responses by central banks to unfreeze dislocated asset markets go beyond temporary operations, with all three central banks opting for outright transactions to assist market liquidity directly in key segments of their respective fixed income markets.

To the extent that a broad collateral framework, as in the case of the Eurosystem, has certain merits in terms of immediately mitigating a funding liquidity crisis, it also brings with it certain challenges. Firstly, the acceptance of assets as collateral for which markets remain seriously dislocated increases liquidation risk, and in the case of "own use" of secured assets, it also increases the concentration risk assumed by the central bank on its balance sheet. Hence, such a collateral framework needs to be combined with vigilant monitoring, and the risk control framework needs to be constantly adjusted to counteract unwarranted practices in the use of collateral by counterparties. This requires a very sound information base and a high level of human resources for monitoring financial market innovations, developing pricing models and refining risk control measures. The Eurosystem has been aware of an increase in residual financial risks in the context of its collateral framework since the outbreak of the financial market crisis, and has continuously redefined its risk control framework (see sub-section 3.1).

Secondly, as the Bank for International Settlements warned in its 2008 Annual Report, the large-scale intermediation of ailing capital markets by the central bank may create price distortions in the longer term. Making a wide range of liquid and illiquid assets eligible for central bank refinancing may – if not adjusted for by the central bank via risk control measures and adequate pricing policy – lead to a preferential treatment of illiquid assets relative to liquid ones, raise the relative price of illiquid assets and lead to oversupply and a consequent impact on credit allocation.

Third, a collateral framework that allows the "own use" of secured instruments in credit operations with the central bank as a permanent feature, could reduce incentives for bank issuers to revive their third party investor base and reactivate markets.

Finally, a broad collateral framework risks not creating the appropriate incentives for banks to manage liquidity risk properly, allowing them to divest of highly liquid assets such as government bonds in exchange for illiquid assets. How to preserve the feature of an effective, immediate crisis-mitigation tool, while at the same time containing unwarranted market distortions and not diluting incentives for prudent risk management, is an important area of future analysis and policy research.

5 CONCLUSION

Prior to the financial market turmoil, there was a general consensus that there is no one optimal way to implement monetary policy and that a central bank's operational and collateral framework is shaped by the specific internal and external circumstances that the central bank faces. This paper has showed how external factors, such as legal constraints, the depth of a country's capital markets and the structure of its banking system can significantly affect the design of a central bank's collateral and operational framework. It has also illustrated how internal decisions by the central bank, such as whether to primarily supply liquidity to the banking sector through outright or temporary operations and whether to differentiate collateral according to the type of operation, can also have an important impact on the collateral framework. The interaction between these external and internal factors resulted in the Eurosystem, the Federal Reserve and the Bank of England having very different operational and collateral frameworks in the period prior to the crisis. In fact, the Eurosystem and the Federal Reserve's frameworks were different in almost every respect, in terms of the range of eligible counterparties, the type of eligible collateral, the size of the temporary versus outright operations and the emphasis placed on achieving market neutrality. Despite these differences, all three central banks were able to implement monetary policy in a highly effective way during the pre-crisis period.

Although the recent experience of the financial market turbulence has not undermined this conclusion, it has shown that having a "broad" collateral framework and a "broad" range of counterparties – whether this is a permanent feature of the framework or only implemented in the event of a crisis – can have substantial benefits in terms of an immediate crisis mitigation tool. While the Federal Reserve, the Bank of England and the Eurosystem all expanded the range of eligible collateral during the turmoil, the Federal Reserve and the Bank of England, which entered the turmoil with a narrower range of eligible collateral than the Eurosystem, accordingly had to expand their eligible collateral even more. The vast majority of the measures implemented by the Federal Reserve and the Bank of England to alleviate strains in wholesale interbank markets and dislocated asset markets were included in the pre-crisis Eurosystem temporary operations.

However, implementing a broad collateral framework and having a broad range of counterparties brings with it other challenges. It requires very intense monitoring of use of collateral practices and tight control via risk control measures. Moreover, it needs to be ensured that banks manage their liquidity risks in a prudent way and do not take unwarranted risks in the expectation that the central bank will bail them out if they run into liquidity problems. Finally, it may complicate the task of restoring a proper market functioning as banks might easily become overly dependent on the central bank's intermediation function. This is an area of great interest to central banks and in which much more research still needs to be done.

ANNEX

COMPARISON OF THE MAIN FEATURES OF THE MONETARY POLICY OPERATIONAL FRAMEWORKS OF THE FEDERAL RESERVE SYSTEM, EUROSYSTEM AND BANK OF ENGLAND

	Eurosystem	Federal Reserve	Bank of England
Key policy rate/ operational target	Key policy rate is the minimum bid rate in the MROs; there is no formal operational target.	Uncollateralised interbank (Federal funds) rate.	The key policy rate is the official Bank Rate paid on commercial bank reserves; the operational target is the overnight unsecured interest rate.
Standing facilities	Yes	Yes	Yes
- Form and maturity	Both a collateralised loan and deposit facility; overnight maturity.	Primary credit facility but no deposit facility.	Lending facility: repo, overnight maturity. Deposit facility: unsecured deposit, overnight
- Access limits	All supervised credit institutions which fulfil certain operational criteria. No limit on size of borrowing, subject to sufficient collateral.	Banks in sound financial condition have access to the primary credit facility. No limit on size of borrowing, subject to sufficient collateral.	All banks with pound sterling liabilities above a certain minimum size, which for that reason must place zero-yielding "cash ratio" deposits at the Bank under the 1998 Act, can have access. No limit on size of borrowing, subject to sufficient collateral
- Corridor width	Loan facility 100 basis points above minimum bid rate, reduced to 50 basis points on 9 October 2008. Deposit facility 100 basis points below minimum bid rate, also reduced to 50 basis points on 9 October 2008.	Normally 100 basis points above the Federal funds target, but reduced to 50 basis points on 16 August 2007 and further reduced to 25 basis points on 17 March 2008.	Loan / deposit facility 100 basis points above and below the Bank Rate; reduced to +/- 25 basis points on last day of maintenance period.
- Eligible collateral	A wide range of public and private sector securities and non-marketable claims.	A wide range of public and private sector securities and non-marketable claims.	Central government and central bank securities; international institution bonds.
Reserve requirements	Yes, mandatory	Yes, mandatory	Yes, voluntary/contractual reserve targets
- Reserve ratios	Domestic currency/foreign currency: 2%	Domestic currency: 0-10%	N/A
- Averaging	Yes	Yes	Yes
- Carry over	No	Yes	No
- Maintenance period	Variable length, normally 4-5 weeks	2 weeks	1 month
- Remuneration	Yes, fully remunerated at the MRO rate	Yes, fully remunerated since the end of 2008	Yes, at the bank rate
Outright operations	No	Yes	Yes
- Function	Currently not used as a monetary policy instrument	Traditionally, the outright portfolio mirrored the volume of banknotes in circulation and provided the main way of refinancing the banking sector. But the portfolio has decreased in size since the start of the turmoil, replaced by temporary operations.	To mirror the volume of banknotes in circulation.
- Type of assets	N/A	Government bonds.	Government bonds; in the future, also foreign currency government bonds swapped into fixed rate sterling.

	Eurosystem	Federal Reserve	Bank of England
Main temporary open market operations	Yes	Yes	Yes
- Function	Main way of refinancing the banking sector so banks can fulfil reserve requirements.	Fine-tuning (short-term), seasonal swings in autonomous factors (longer-term).	Main way of refinancing the banking sector so banks can fulfil reserve requirements.
- Type of operation	Collateralised lending (pledge); repurchase agreements are only marginally used.	Repurchase agreements.	Repurchase agreements.
- Counterparties	1,500 eligible banks; in practice 400-500 participate regularly.	A known set of 20 "primary dealers".	All banks which fulfil reserves requirements with the central bank.
- Maturities	2 week MROs; 3 month longer-term refinancing operations (LTROs).	Usually overnight to 14 days; up to 65 days allowable.	1-week fixed rate repos; long-term (3, 6, 9, 12 month) variable rate repos.
- Frequency	Weekly (MROs); monthly (LTROs).	Daily (short-term); weekly (longer-term).	Weekly (short-term repos); monthly (long-term repos)
- Collateral	Same collateral as for standing facility.	US Treasury securities, US agency bonds, agency-guaranteed MBSs.	Same collateral as for standing facility.

Source: Amended from the document "Monetary policy frameworks and central bank market operations", Bank for International Settlements, June 2008.

BIBLIOGRAPHY

Adrian, T. and H. S. Shin (2008), "Liquidity and leverage", Federal Reserve Bank of New York Staff Reports, No. 328, May 2008 (revised January 2009).

Armantier, O., S. Krieger, J. McAndrews (2008), "The Federal Reserve's Term Auction Facility", Current Issues in Economics and Finance, 14, No. 5, July 2008.

Bagehot, W. (1873), *Lombard Street: a description of the money market.*

Bank for International Settlements (2008), "Central bank operations in response to the financial turmoil", Committee on the Global Financial System, CGFS Paper 31, July 2008.

Bank of England (2007), "Turmoil in financial markets: what can central banks do?", paper submitted to the UK Treasury Committee, 12 September 2007.

Bank of England (2008a), Financial Stability Report, April 2008.

Bank of England (2008b), "The Developments of the Bank of England's Market Operations: A consultative paper by the Bank of England", October 2008.

Bank of England (2009), Annual Report.

Basel Committee on Banking Supervision (2008), "Liquidity Risk: Management and Supervisory Challenges", February 2008.

Bernanke, B. (2008), "Liquidity Provision by the Federal Reserve", speech delivered at the Federal Reserve Bank of Atlanta Financial Markets Conference.

Bervas, A. (2006), "Market liquidity and its incorporation into risk management", Banque de France Financial Stability Review, May 2006, pp. 63-80.

Bindseil, U., A. Manzanares, and B. Weller (2004), "The role of central bank capital revisited", ECB Working Paper, No. 392.

Bindseil, U. and F. Papadia (2009), "Risk management and market impact of central bank credit operations", in *Risk Management for Central Banks and Other Public Investors*, Cambridge University Press.

Brunnermeier, M.K. and L.H. Pedersen (2008), "Market liquidity and funding liquidity", Review of Financing Studies.

Buiter, Willem H. (2008), "Central Banks and financial crisis", paper presented at the Federal Reserve Bank of Kansas City's symposium on "Maintaining Stability in a Changing Financial System", at Jackson Hole, Wyoming, 21-23 August 2008.

Chailloux, A., S. Gray and R. McCaughrin, "Central bank collateral frameworks: principles and policies", IMF Working Paper, September 2008.

Cincibuch, M., T. Holub and J. Hurnik (2008), "Central bank losses and economic convergence", Czech National Bank Working Paper Series, No. 3.

Diamond and Dybvig (1983), "Bank runs, deposit insurance, and liquidity", Journal of Political Economy, 91, pp. 401-419.

European Central Bank (2008a), "Implementation of Monetary Policy in the Euro area: General Documentation on Eurosystem Monetary Policy Instruments and Procedures", November 2008.

European Central Bank (2008b), "The collateral frameworks of the Federal Reserve System, the Bank of Japan and the Eurosystem", ECB Monthly Bulletin, October 2008.

European Central Bank (2009), Annual Report.

European Mortgage Federation (2007), Hypostat.

Ewerhart and Tapking (2008), "Repo markets, counterparty risk, and the 2007/2008 liquidity crisis", ECB Working Paper Series, No. 909, June 2008.

Federal Reserve Board (2002), "Alternative Instruments for Open Market and Discount Window Operations", December 2002.

Financial Services Authority (2007), "Discussion Paper: Review of liquidity requirements", December 2007.

Fleming, M., W. Hrung and F. Keane (2009), "Term Securities Lending Facility: Origins, Design and Effects", Federal Reserve Bank of New York Research Paper (forthcoming).

Geithner, T. (2008), Testimony before the U.S. Senate Committee on Banking, Housing and Urban Affairs, 3 April 2008.

Hoerdahl, P. and M. King (2008), "Developments in repo markets during the financial turmoil", BIS Quarterly Review, December 2008.

Kohn, D. (2008), "Money markets and financial stability", speech at FRBNY-Columbia Business School Conference on the Role of Money Markets, New York, 29 May 2008.

Institute of International Finance (2007), "Principles of Liquidity Risk Management", March 2007.

International Monetary Fund (2008), "Market and funding illiquidity: When private risk becomes public", IMF Global Financial Stability Report, Chapter 3.

Summers, L. (2007) "Beware the moral hazard fundamentalists", Financial Times, 24 September 2007.

Tapking and Weller (2008) "Open market operations, central bank collateral and the 2007/2008 liquidity turmoil", mimeo.

EUROPEAN CENTRAL BANK
OCCASIONAL PAPER SERIES SINCE 2008

78 "A framework for assessing global imbalances" by T. Bracke, M. Bussière, M. Fidora and R. Straub, January 2008.

79 "The working of the eurosystem: monetary policy preparations and decision-making – selected issues" by P. Moutot, A. Jung and F. P. Mongelli, January 2008.

80 "China's and India's roles in global trade and finance: twin titans for the new millennium?" by M. Bussière and A. Mehl, January 2008.

81 "Measuring Financial Integration in New EU Member States" by M. Baltzer, L. Cappiello, R. A. De Santis, and S. Manganelli, January 2008.

82 "The Sustainability of China's Exchange Rate Policy and Capital Account Liberalisation" by L. Cappiello and G. Ferrucci, February 2008.

83 "The predictability of monetary policy" by T. Blattner, M. Catenaro, M. Ehrmann, R. Strauch and J. Turunen, March 2008.

84 "Short-term forecasting of GDP using large monthly datasets: a pseudo real-time forecast evaluation exercise" by G. Rünstler, K. Barhoumi, R. Cristadoro, A. Den Reijer, A. Jakaitiene, P. Jelonek, A. Rua, K. Ruth, S. Benk and C. Van Nieuwenhuyze, May 2008.

85 "Benchmarking the Lisbon Strategy" by D. Ioannou, M. Ferdinandusse, M. Lo Duca, and W. Coussens, June 2008.

86 "Real convergence and the determinants of growth in EU candidate and potential candidate countries: a panel data approach" by M. M. Borys, É. K. Polgár and A. Zlate, June 2008.

87 "Labour supply and employment in the euro area countries: developments and challenges", by a Task Force of the Monetary Policy Committee of the European System of Central Banks, June 2008.

88 "Real convergence, financial markets, and the current account – Emerging Europe versus emerging Asia" by S. Herrmann and A. Winkler, June 2008.

89 "An analysis of youth unemployment in the euro area" by R. Gomez-Salvador and N. Leiner-Killinger, June 2008.

90 "Wage growth dispersion across the euro area countries: some stylised facts" by M. Anderson, A. Gieseck, B. Pierluigi and N. Vidalis, July 2008.

91 "The impact of sovereign wealth funds on global financial markets" by R. Beck and M. Fidora, July 2008.

92 "The Gulf Cooperation Council countries – economic structures, recent developments and role in the global economy" by M. Sturm, J. Strasky, P. Adolf and D. Peschel, July 2008.

93 "Russia, EU enlargement and the euro" by Z. Polański and A. Winkler, August 2008.

94 "The changing role of the exchange rate in a globalised economy" by F. di Mauro, R. Rüffer and I. Bunda, September 2008.

95 "Financial stability challenges in candidate countries managing the transition to deeper and more market-oriented financial systems" by the International Relations Committee expert group on financial stability challenges in candidate countries, September 2008.

96 "The monetary presentation of the euro area balance of payments" by L. Bê Duc, F. Mayerlen and P. Sola, September 2008.

97 "Globalisation and the competitiveness of the euro area" by F. di Mauro and K. Forster, September 2008.

98 "Will oil prices decline over the long run?" by R. Kaufmann, P. Karadeloglou and F. di Mauro, October 2008.

99 "The ECB and IMF indicators for the macro-prudential analysis of the banking sector: a comparison of the two approaches" by A. M. Agresti, P. Baudino and P. Poloni, November 2008.

100 "Survey data on household finance and consumption: research summary and policy use" by the Eurosystem Household Finance and Consumption Network, January 2009.

101 "Housing finance in the euro area" by a Task Force of the Monetary Policy Committee of the European System of Central Banks, March 2009.

102 "Domestic financial development in emerging economies: evidence and implications" by E. Dorrucci, A. Meyer-Cirkel and D. Santabárbara, April 2009.

103 "Transnational governance in global finance: the principles for stable capital flows and fair debt restructuring in emerging markets" by R. Ritter, April 2009.

104 "Fiscal policy challenges in oil-exporting countries – a review of key issues" by M. Sturm, F. Gurtner and J. Gonzalez Alegre, June 2009.

105 "Flow-of-funds analysis at the ECB – framework and applications" by L. Bê Duc and G. Le Breton, August 2009.

106 "Monetary policy strategy in a global environment" by P. Moutot and G. Vitale, August 2009.

107 "The collateral frameworks of the Eurosystem, the Federal Reserve System and the Bank of England and the financial market turmoil" by S. Cheun, I. von Köppen-Mertes and B.Weller, December 2009.

ISSN 1607-1484