RECENT DEVELOPMENTS IN THE BALANCE SHEETS OF THE EUROSYSTEM, THE FEDERAL RESERVE SYSTEM AND THE BANK OF JAPAN

During the financial market turmoil, which started in August 2007, the size and composition of central bank balance sheets have changed significantly as a result of exceptional monetary policy operations. This article explains these recent developments using simplified versions of the balance sheets of the Eurosystem, the Federal Reserve System (hereinafter referred to as "the Federal Reserve") and the Bank of Japan. The massive expansion and increasing complexity of the balance sheets of these three central banks, especially in the aftermath of the bankruptcy of Lehman Brothers in September 2008, are evidence of their strong response to the severe deterioration in financial and economic conditions.

1 INTRODUCTION

The balance sheet of a central bank provides detailed information about how it uses its monetary policy instruments. It is therefore also a useful guide for understanding how monetary policy is implemented. The changes in balance sheets that have occurred since the start of the financial market turmoil show that central banks have used existing tools in innovative ways, as well as introduced new ones, in order to relieve liquidity shortages and ensure the smooth functioning of money markets, which is essential for the transmission of monetary policy. As central banks have stepped up their intermediation role in money markets and offered crucial support to other credit markets during the financial turmoil, particularly after the bankruptcy of Lehman Brothers in September 2008, the size and complexity of their balance sheets have increased significantly.

This article describes and compares the evolution of the balance sheets of the Eurosystem, the Federal Reserve and the Bank of Japan.[1] As there are differences in the monetary policy implementation frameworks and accounting standards of these central banks, the comparison is not based on their detailed financial statements but on simplified versions thereof (hereinafter referred to as "simplified balance sheets").

Between June 2007 and December 2008, the total assets of the Eurosystem and the Federal Reserve grew considerably, by 90% and 160% respectively, as a result of the measures introduced in response to the financial turmoil. With the improvement in money market conditions in the first half of 2009, the total assets of the Eurosystem declined by about 20% and those of the Federal Reserve by 10%. However, high demand for the Eurosystem's first one-year refinancing operation, conducted on 24 June 2009, triggered an increase once again in the size of the Eurosystem's balance sheet, almost to its peak level. By contrast, the Bank of Japan's balance sheet was relatively large in 2007 owing to the significant increase in outstanding banknotes in the late 1990s, which meant that the level of banknotes in circulation remained above its long-term trend. The Bank of Japan's balance sheet therefore grew by only 25% between June 2007 and March 2009, when it peaked as a result of the financial turmoil.

Several factors have contributed to the considerable expansion and increased complexity of the balance sheets of these three central banks during the financial turmoil. Prior to September 2008, the Eurosystem and the Federal Reserve increased the number of refinancing operations, especially at term maturities, and introduced foreign currency liquidity-providing operations. At the same time, the Bank of Japan relied on instruments that were developed during the financial crisis in Japan in the 1990s and therefore already contained unconventional elements, such as longer maturities and a wider range of eligible collateral. Subsequently, during the more intense phase of the financial turmoil, when interest rates came close to zero, all three central banks focused increasingly on the transmission of monetary policy to the real sector of the economy. As a result, it became essential to

1 This article covers the period up to the end of August 2009.

support major credit markets through outright asset purchases or special lending facilities. Section 2 introduces the concept of simplified balance sheets and Section 3 reviews the developments in the balance sheets of the three central banks in more detail.

2 SIMPLIFIED BALANCE SHEETS: RATIONALE AND DEFINITION

The Eurosystem, the Federal Reserve and the Bank of Japan have different frameworks for the implementation of monetary policy and different reporting rules, which is reflected in the structure of their balance sheets. Thus, in order to make a comparison of these balance sheets easier and more meaningful, it is based on simplified versions thereof (the box describes the construction of the simplified balance sheets in more detail).

The simplified balance sheet aggregates and nets several items reported in the financial statement in order to highlight monetary policy implementation and facilitate liquidity analysis. It presents the relationship between the size and type of monetary policy instrument, in both domestic and foreign currencies, as well as the main autonomous liquidity factors.

The three main categories of item on the simplified balance sheet are (i) autonomous liquidity factors, (ii) foreign currency liquidity-providing operations that were introduced during the financial market turmoil to provide foreign currency to domestic counterparties, and (iii) monetary policy instruments that are used to steer domestic money market interest rates and, as of September 2008, to support certain credit market segments (see Table 1). All of these items appear on both the asset side and the liability side of the balance sheet.

Autonomous liquidity factors are balance sheet items such as banknotes in circulation and government deposits, over which central banks have little or no control, but which may affect interest rates or liquidity conditions in the short run. For the purposes of this article, autonomous liquidity factors on the asset side of the balance sheet include net foreign assets (i.e. foreign currency denominated assets held outright for foreign exchange intervention or for investment purposes) and, in the case of the Eurosystem, domestic assets that are held outright by NCBs and not used for monetary policy implementation. On the liability side, they include banknotes in circulation, government deposits (i.e. Treasury departments' current account holdings with NCBs) and a residual item called "other autonomous factors (net)".

The foreign currency liquidity-providing operations, which have been carried out in response to the financial market turmoil, consist of swaps and repos through which central banks supply foreign currency to domestic interbank markets. The foreign currency for these operations has been obtained through swap arrangements with partner central banks.

Monetary policy instruments also appear on both the asset side and the liability side of the simplified balance sheet. Short-term and long-term repo operations, lending facilities and outright portfolios are on the asset side, while the current accounts held by credit institutions to fulfil minimum reserve requirements or for transaction purposes, liquidity-absorbing operations (e.g. fixed-term deposits and reverse repos), deposit facilities and other liquidity-absorbing tools are reported on the liability side.

Table 1 Simplified balance sheets of the Eurosystem, the Federal Reserve and the Bank of Japan as at the end of August 2009

Assets			Liabilities		
(a) Eurosystem[1] (EUR billions)					
Autonomous liquidity factors					
Net foreign assets	392	(317)	Banknotes in circulation	767	(633)
Domestic assets[2]	341	(131)	Government deposits	136	(70)
			Other autonomous factors (net)	189	(27)
Foreign currency liquidity-providing operations					
USD repos	31	(0)	Claims of the Federal Reserve	31	(0)
DKK swaps	0	(0)	Claims of the Swiss National Bank	19	(0)
SEK swaps	3	(0)			
Monetary policy instruments					
Covered bond portfolio	9	(0)	Current accounts	203	(182)
Main refinancing operations	78	(313)	Absorbing operations	0	(0)
Longer-term refinancing operations	634	(150)	Deposit facility	143	(1)
Fine-tuning operations	0	(0)			
Marginal lending facility	0	(1)			
Total	1,488	(913)		1,488	(913)
(b) Federal Reserve[3] (USD billions)					
Autonomous liquidity factors					
Net foreign assets	38	(34)	Banknotes in circulation	870	(775)
			Government deposits	13	(4)
			Other autonomous factors (net)	76	(49)
Foreign currency liquidity-providing operations					
Central bank liquidity swaps	60	(0)			
Monetary policy instruments					
Domestic assets	1,485	(790)	Current accounts	862	(16)
Repos	0	(20)	Reverse repos	0	(0)
Term Auction Facility	221	(0)	Treasury supplementary financing account	200	(0)
Other lending	217	(0)			
Total	2,021	(845)		2,021	(845)
(c) Bank of Japan[1] (JPY 100 billions)					
Autonomous liquidity factors					
Foreign assets	54	(57)	Banknotes in circulation	762	(758)
			Government deposits	29	(42)
			Other autonomous factors (net)	139	(-59)
Foreign currency liquidity-providing operations					
USD repos	8	(0)	Claims of the Federal Reserve	8	(0)
Monetary policy instruments					
Domestic assets	596	(578)	Current accounts	119	(97)
Repos	399	(204)	Reverse repos	0	(0)
Other lending	0	(0)	Bank of Japan bills sold	0	(0)
Total	1,056	(838)		1,056	(838)

Sources: ECB calculations based on the Eurosystem's weekly financial statement (weekly data); the Federal Reserve's H.4.1 statistical release, Table 9 "Consolidated statement of condition of all Federal Reserve banks" (previously Table 8), and Wednesday Historical Levels, Table 16 (weekly data); Bank of Japan accounts and "Monetary Base and the Bank of Japan's transactions" (monthly data).
1) As at 28 August 2009 (figures as at 29 June 2007 are provided in parentheses).
2) Of which the sub-item "federal government debt denominated in euro" stood at €37 billion on 29 June 2007 and at €36 billion on 28 August 2009.
3) As at 26 August 2009 (figures as at 27 June 2007 are provided in parentheses).

Box

SIMPLIFIED BALANCE SHEETS: METHODOLOGY

The simplified balance sheets standardise the information presented in the central banks' financial statements by aggregating and netting certain items, with the degree of netting dependent on the level of detail in the respective financial statement. For example, the Eurosystem's financial statement provides very detailed information on accounts unrelated to monetary policy. The ratio of total assets on the simplified balance sheet to total assets on the financial statement is approximately 4:5 for the Eurosystem and the Bank of Japan and almost 1:1 for the Federal Reserve.

The simplified balance sheets have three main categories of asset and liability: autonomous liquidity factors, foreign currency liquidity-providing operations and monetary policy instruments.

Autonomous liquidity factors

On the asset side of the simplified balance sheet, autonomous liquidity factors comprise the item "net foreign assets", which covers all accounts denominated in foreign currency, including gold and special drawing rights but excluding the foreign exchange liquidity-providing operations, and subtracts liabilities from assets. The Eurosystem's simplified balance sheet has an additional autonomous factor on the asset side, namely "domestic assets". These are securities and government debt denominated in euro which are held outright by euro area central banks for investment purposes at their own financial risk. These portfolios are subject to maximum size limits, agreed at the Eurosystem level, in order to ensure that they do not interfere with the implementation of the single monetary policy.

The liquidity-absorbing autonomous factors, reported on the liability side of the simplified balance sheet, are banknotes and government deposits. A residual category called "other autonomous factors (net)" is computed as the difference between the sum of all liability accounts and the sum of all asset accounts of the financial statement that are not reported on the simplified balance sheet. None of these netted items are linked to the implementation of monetary policy.

At the end of 2008 an accounting reclassification changed the composition of the Eurosystem's weekly financial statement so that part of the central banks' investment portfolios were moved from item A9 ("other assets") to item A7 ("securities by euro area residents denominated in euro"). While this accounting reclassification did not affect the size of the weekly financial statement, it resulted in an expansion of the Eurosystem's simplified balance sheet since, unlike item A9, item A7 is not netted out under the item "other autonomous factors (net)". The resulting level shift of €157.4 billion in "domestic assets" recorded in the simplified balance sheet on 2 January 2009 reflects, to some extent, the actual expansion of investment portfolios in the period from mid-2007 to the end of 2008. Prior to the accounting reclassification, this had been reported under "other assets" in the weekly financial statement.[1]

Foreign currency liquidity-providing operations

Central banks usually report all foreign currency operations under the same foreign asset and liability items of their financial statements. However, the operations introduced in response to the

1 See the press release of 7 January 2009, available at http://www.ecb.europa.eu/press/pr/wfs/2009/html/fs081231.en.html.

financial turmoil are presented separately in the simplified balance sheets used for the purposes of this article. In these operations, the Federal Reserve provides other central banks with US dollars and thus acquires a claim reported under "central bank liquidity swaps" in its balance sheet. In exchange for the US dollar funds, the Federal Reserve receives euro (yen) funds and deposits them with the Eurosystem (Bank of Japan). This euro (yen) deposit is shown under "claims of the Federal Reserve" on the liability side of the Eurosystem's (Bank of Japan's) balance sheet.[2] The US dollar funds received from the Federal Reserve are currently being used by the Eurosystem to conduct US dollar liquidity-providing operations with its counterparties in the form of repos. The item "USD repos", which appears on the asset side of the Eurosystem's simplified balance sheet, indicates the claim denominated in US dollars that the Eurosystem acquires vis-à-vis its counterparties in the repo operations. Similarly, the USD repos conducted by the Bank of Japan are shown as an asset in its balance sheet.

Until January 2009 the Eurosystem also conducted US dollar liquidity-providing operations in the form of swaps. In these swap operations, the Eurosystem supplied its counterparties with US dollars in exchange for euro, which were debited (subtracted) from the current accounts of the counterparties. The CHF/EUR swap operations, conducted in cooperation with the Swiss National Bank, are similar transactions: the Swiss National Bank receives euro in exchange for Swiss francs and deposits the euro with the Eurosystem. This euro deposit is reported under the liability item "claims of the Swiss National Bank". The Eurosystem also has reciprocal currency arrangements with Danmarks Nationalbank and Sveriges Riksbank. Through the EUR/DKK and EUR/SEK swaps, credit institutions in Denmark and Sweden receive euro in exchange for domestic currency. The Eurosystem deposits the Danish kroner and the Swedish kronor with the respective central banks and thus acquires claims denominated in foreign currency, which are reported under "DKK swaps" and "SEK swaps" on the Eurosystem's simplified balance sheet.

Monetary policy instruments

The main differences in the simplified balance sheets of the three central banks being analysed in this article are in the items reported under monetary policy instruments. In the case of the Eurosystem, the simplified balance sheet shows the liquidity provided through one-week main refinancing operations; one, three, six and 12-month longer-term refinancing operations; fine-tuning operations; and the overnight marginal lending facility. A large set of collateral, containing both private and public debt, is eligible for these operations, which are currently open to around 2,200 counterparties. In addition, the Eurosystem's monetary policy instruments include the covered bond portfolio which has been built up since July 2009 and which is clearly separated from outright portfolios held by euro area central banks ("domestic assets").

While in the case of the Eurosystem and to a lesser extent the Bank of Japan, refinancing operations have tended to account for a large share of total assets on the simplified balance sheet, even before the financial turmoil, such operations accounted for a relatively small share of total assets in the case of the Federal Reserve, with repos traditionally being used to address only temporary fluctuations in the banking system's liquidity needs.

For both the Federal Reserve and the Bank of Japan, outright portfolios (domestic assets) play an active role in the implementation of their monetary policies and are, for the purposes of this

2 The forward leg of the swap transactions is booked off-balance sheet.

article, reported as monetary policy instruments in the simplified balance sheet. The securities currently held by the Federal Reserve include Treasury bills, notes and bonds, federal agency debt securities and, since January 2009, federal agency mortgage-backed securities. Before the start of the financial market turmoil, the Federal Reserve tended to steer the size of its outright portfolio towards the level of outstanding banknotes. The assets currently held by the Bank of Japan include government bonds, Treasury discount bills and stocks held in pecuniary trusts, as well as commercial paper and corporate bonds since February and March 2009 respectively. The outright holdings of Japanese government bonds have been kept below the amount of banknotes issued.

Additionally, the asset side of the Federal Reserve's simplified balance sheet shows the Term Auction Facility, which was introduced in response to the financial turmoil. Compared with the Federal Reserve's regular repo operations, a larger number of counterparties (approximately 7,000 vis-à-vis the 18 in the regular repo operations) are able to participate in these operations against a broadened range of collateral. In the case of the Federal Reserve, the simplified balance sheet item "other lending" consists of the "other loans" and "net portfolio holdings" reported in its financial statement and contains many of the credit easing measures undertaken by the Federal Reserve (see Section 3.1 for more details). In the case of the Bank of Japan, "other lending" includes special fund-supplying operations against corporate debt that were introduced in January 2009, as well as the complementary lending facility, which provides overnight loans to counterparties upon request.

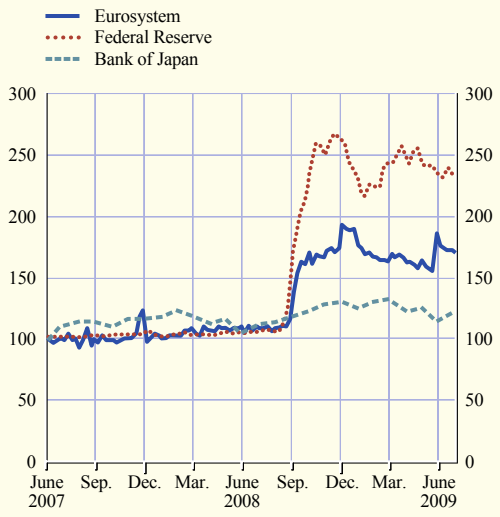
The monetary policy instruments reported on the liability side of the simplified balance sheet include the current accounts of credit institutions, as well as several other liquidity-absorbing monetary policy instruments. The current accounts cover the minimum reserve requirements, as well as the "excess reserve" holdings, i.e. the current account holdings in excess of the minimum reserve requirements. The Eurosystem offers a deposit standing facility that enables counterparties to deposit liquidity on an overnight basis. The "absorbing operations" item on the Eurosystem's simplified balance sheet consists of the collection of fixed-term deposits, which, in contrast to the reverse repos of the Federal Reserve and the Bank of Japan, do not involve a transfer of collateral to counterparties. The "US Treasury supplementary financing account" contains deposits made by the US Treasury with the Federal Reserve as part of a scheme that was introduced in September 2008 in order to absorb some of the excess liquidity provided through the new lending facilities. Finally, the item "Bank of Japan bills sold" contains bills issued by the Bank of Japan.

3 BALANCE SHEET DEVELOPMENTS SINCE JUNE 2007

During the first phase of the financial turmoil, which lasted until September 2008, the size of the central banks' balance sheets did not change noticeably (see Chart 1). Liquidity injections were offset through the sale of central bank assets or downward adjustments to the size of the refinancing operations towards the end of the maintenance period, in order to ensure that no excess liquidity remained in the banking system. However, after the financial turmoil intensified in the fourth quarter of 2008, the Eurosystem undertook a number of enhanced credit support measures and the Federal Reserve introduced a credit easing programme, both of which triggered a significant expansion in their respective balance sheets. Subsequent improvements in money market conditions during the first half of 2009 led to a reduction in the total assets of the Eurosystem and the Federal Reserve. However, high demand for

Chart 1 Total assets on the simplified balance sheet

(June 2007 = 100)



Sources: Eurosystem, Federal Reserve, Bank of Japan and ECB calculations.
Note: The increase in the Eurosystem's total assets recorded on 2 January 2009 resulted from an accounting reclassification. Expansions of investment portfolios in previous years were reflected on the asset side of the simplified balance sheet (see the box).

the one-year refinancing operation, conducted on 24 June 2009, triggered a second increase in the size of the Eurosystem's balance sheet. Owing to the high level of outstanding banknotes caused by above-trend growth in the late 1990s, the Bank of Japan's balance sheet was relatively large before the start of the financial market turmoil, with the result that its increase in size over the past two years has been smaller.

Table 2 Total assets on the simplified balance sheet relative to GDP and banknotes in circulation

	Eurosystem	Federal Reserve	Bank of Japan
	Relative to GDP (%)		
June 2007	10	6	16
Peak	19	15	23
Peak reference date	2/01/09	17/12/08	31/03/09
August 2009	16	14	22
	Relative to banknotes in circulation (%)		
June 2007	144	109	111
Peak	231	266	144
Peak reference date	2/01/09	17/12/08	31/03/09
August 2009	194	232	139

Sources: Eurosystem, Federal Reserve, Bank of Japan and ECB calculations.

Table 2 shows total assets as a share of GDP and as a share of banknotes in circulation for the euro area, the United States and Japan. Prior to the implementation of the turmoil-related measures, the balance sheets of these three central banks differed in size relative to GDP and banknotes in circulation. The Federal Reserve had the smallest balance sheet relative to both GDP and banknotes in circulation, while the Eurosystem and the Bank of Japan had the largest in terms of banknotes in circulation and relative to GDP respectively. These differences can be explained, at least in part, by various factors, such as different financial market structures, monetary policy implementation frameworks and economic conditions. The increase in central bank assets since October 2008 has made the Federal Reserve's balance sheet the largest relative to banknotes, even if it has remained the smallest in terms of GDP. The following sections describe the factors that contributed to the expansion of central bank assets.

3.1 IMPACT OF LIQUIDITY-PROVIDING INSTRUMENTS

The significant increase in size and the change in composition of the simplified balance sheets were triggered by the measures taken by the central banks to address the tensions in the money markets with a view to ensuring the smooth implementation of monetary policy.

EUROSYSTEM

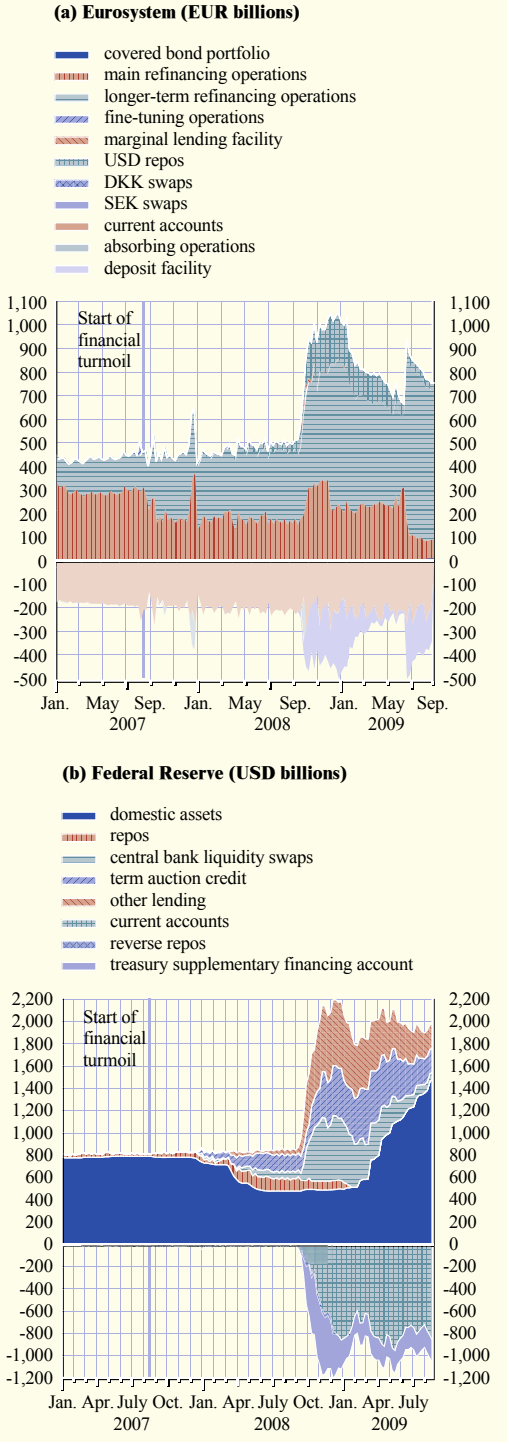
During the first phase of the financial market turmoil, the main change to the Eurosystem's approach to liquidity management – the increase in the allotment amounts and frequency of longer-term refinancing operations (LTROs) – did not affect the size of the simplified balance sheet. It only affected the ratio of LTROs to one-week refinancing operations, with LTROs constituting one-third of the total outstanding refinancing before the financial turmoil and two-thirds in September 2008.

In October 2008 the Eurosystem launched a series of enhanced credit support measures, which were supplemented by several additional tools in May 2009. First, the Eurosystem started to conduct all refinancing operations at a fixed rate while allotting all bids received from counterparties. This operational change was coupled with a temporary expansion of the already long list of collateral eligible for open market operations – the second building block of the enhanced credit support package. Third, the number and frequency of LTROs with maturities ranging from one to six months were raised. These three facets of the enhanced credit support programme resulted in a significant increase in the size of the Eurosystem's balance sheet. The outstanding amount of LTROs went up from €150 billion in June 2007 to over €600 billion at the end of 2008, almost doubling the total amount of outstanding refinancing, which peaked at €850 billion on 2 January 2009 (see Chart 2(a)). The outstanding amount of main refinancing operations (MROs) also increased from an average of €190 billion during the first phase of the financial turmoil to €340 billion at the beginning of December 2008; thereafter it decreased.

In the first half of 2009, as money market conditions had improved, demand for one, three and six-month LTROs declined gradually to €400 billion. Nevertheless, the Eurosystem left the exceptional liquidity measures in place to encourage banks to lend to the real sector. Moreover, on 24 June 2009, it carried out its first one-year LTRO, which was introduced as an extension of the third enhanced credit support measure mentioned above. Counterparties' interest in this operation was very high and the allotted amount was €442 billion, resulting once again in a significant increase in the size of the Eurosystem's balance sheet. The total amount of outstanding refinancing reached €900 billion at the end of June 2009.

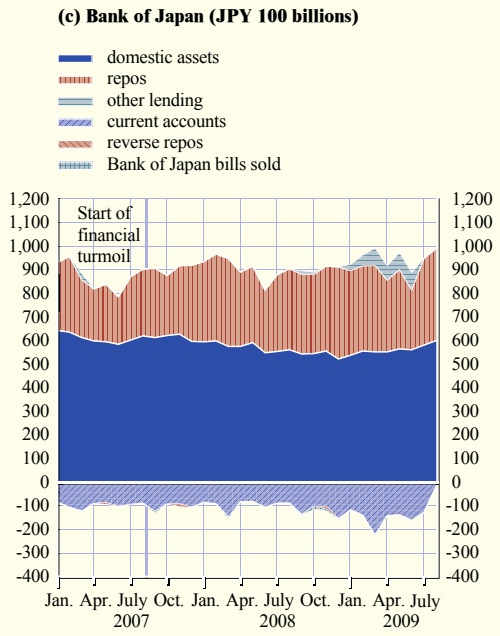
In July 2009 the Eurosystem implemented the fourth building block of the enhanced credit support programme, namely the outright purchase of covered bonds. A portfolio worth

Chart 2 Monetary policy instruments



Sources: Eurosystem, Federal Reserve (weekly data) and Bank of Japan (monthly data).

Chart 2 Monetary policy instruments



Sources: Eurosystem, Federal Reserve (weekly data) and Bank of Japan (monthly data).

€9 billion was purchased during the first two months and the total amount is expected to reach €60 billion by the end of June 2010. This measure brought about an important change in the Eurosystem's balance sheet: the item "securities of euro area residents denominated in euro" became divided into two sub-items, i.e. the covered bond portfolio, used for monetary policy implementation, and the investment assets of the euro area central banks, which are an autonomous factor.

FEDERAL RESERVE

The regular repo operations of the Federal Reserve, normally used to correct temporary fluctuations in the banking system's liquidity needs, amounted to USD 30 billion on average during the first half of 2007. In early 2008 the Federal Reserve launched a one-month term repo programme, which pushed up the outstanding amount of repos to USD 130 billion in May 2008. As the lending programmes introduced following the bankruptcy of Lehman Brothers generated large levels of excess reserve balances, the Federal Reserve stopped conducting its regular repos in January 2009 (see Chart 2(b)). In December 2007 the Federal Reserve launched the Term Auction Facility (TAF) in order to lend term funds, raising the maximum maturity to three months in 2008. The outstanding amount of the TAF peaked at almost USD 500 billion in March 2009 and has since fallen to around USD 220 billion.

In addition to the regular repos and the TAF, changes in the outright portfolio have affected the size and composition of the Federal Reserve's balance sheet during the financial turmoil. Initially, the Federal Reserve sold Treasury securities worth around USD 300 billion between June 2007 and September 2008 in order to compensate for the liquidity provided through the TAF and the other new lending programmes. However, in the context of its credit easing policy, the Federal Reserve started to purchase federal agency debt securities in September 2008 and federal agency mortgage-backed securities in January 2009. This portfolio totalled USD 740 billion in August 2009. Moreover, in April 2009 the Federal Reserve resumed its purchases of Treasury securities and thus had increased its portfolio by USD 270 billion by the end of August 2009.

Finally, the item "other lending" contributed significantly to the strong expansion of the Federal Reserve's balance sheet. This item includes the discount window, which is a standing lending facility available to depository institutions. After the Federal Reserve reduced the spread between the discount window rate and its target for the federal funds rate, from 100 to 50 basis points in August 2007 and to 25 basis points in March 2008, and extended the maturity of discount window lending from overnight to 30 days and 90 days respectively, the use of the discount window increased from an average of USD 200 million in June 2007 to almost USD 100 billion in October 2008. Moreover, in March 2008, the primary

dealers (i.e. a limited group of non-bank financial intermediaries which constitute the counterparties of the Federal Reserve for the usual open market operations) were given access to a similar overnight standing lending facility – the Primary Dealer Credit Facility.

The Federal Reserve balance sheet item "other lending" also includes several credit easing tools that were introduced after September 2008. First, the Federal Reserve launched the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility to finance credit institutions' purchases of asset-backed commercial paper from money market mutual funds. In October 2008 the Commercial Paper Funding Facility was established to enhance the liquidity of the commercial paper market and the Money Market Investor Funding Facility to provide liquidity to money market investors. In March 2009 the Term Asset-backed Securities Loan Facility was launched to support the issuance of asset-backed securities collateralised by consumer and small business loans. These new lending programmes, the greater use of the discount window, the funding provided in the context of the merger between Bear Stearns and JPMorgan Chase and the restructuring of AIG increased "other lending" from USD 190 million at the end of June 2007 to a peak of USD 600 billion at the end of 2008. As was the case with the Eurosystem's LTROs, the improvement in financial market conditions led to a decrease in demand for the new lending facilities to USD 220 billion by the end of August 2009.

BANK OF JAPAN

Like the Eurosystem and the Federal Reserve, the Bank of Japan has also expanded the size and changed the composition of its balance sheet, but not on such a large scale. First, since June 2007, it has increased the level of its repo operations by around JPY 19 trillion (see Chart 2(c)). Second, the Bank of Japan's holdings of Japanese government bonds declined in 2007 and 2008, mainly because purchases of Japanese government bonds were lower than those of redemptions. To support credit markets during the financial turmoil, the Bank of Japan started to purchase commercial paper in February 2009 and corporate bonds in March 2009, the total amounts in August 2009 being JPY 100 billion and JPY 250 billion respectively. Finally, in order to facilitate corporate financing, in January 2009 the Bank of Japan introduced special fund-supplying operations with a fixed rate, for an unlimited amount and backed by corporate debt. These operations meant that the item "other lending" reached JPY 7.5 trillion in March 2009.

CENTRAL BANK COLLABORATION

A major innovation that marked an important step in central bank collaboration during the global financial turmoil was introduced in December 2007, when the ECB and several other central banks decided to take joint action with the Federal Reserve by providing US dollar liquidity against domestic collateral to their domestic counterparties through swap arrangements. While the central banks have traditionally relied on swap lines solely for foreign exchange intervention, the activation thereof during the financial market turmoil addressed money market frictions and brought about a qualitative change in the composition of the central banks' simplified balance sheets. The total outstanding amount of US dollar swap operations on the simplified balance sheet of the Federal Reserve reached almost USD 600 billion, a quarter of its total assets, in mid-December 2008. In the same month almost half of the USD 600 billion in central bank liquidity swaps (equivalent to €200 billion) were on the liability side of the Eurosystem's simplified balance sheets, while the corresponding figure for the Bank of Japan was one-fifth (equivalent to JPY 11 trillion). In 2009 international demand for US dollar refinancing declined gradually to reach USD 60 billion on the Federal Reserve's simplified balance sheet in August, of which the equivalent of €31 billion was supplied in the euro area and the equivalent of around JPY 770 billion in Japan.

In addition to the US dollar operations, since October 2008 the Eurosystem, in cooperation

with the Swiss National Bank, has conducted CHF/EUR swaps, providing the equivalent of €33 billion on average. Since November 2008 the Eurosystem has also provided an average of €3 billion to Danish credit institutions through an EUR/DKK swap agreement with Danmarks Nationalbank. Similarly, since June 2009 the Eurosystem has supplied €3 billion to counterparties of Sveriges Riksbank through an EUR/SEK swap line. These foreign currency liquidity-providing operations were the fifth building block of the Eurosystem's enhanced credit support programme.

3.2 DEVELOPMENTS STEMMING FROM LIQUIDITY-ABSORBING INSTRUMENTS

The three central banks have absorbed excess liquidity by means of different instruments. For the Eurosystem, the liability item that has seen the largest increase is the deposit facility. First, it rose from around €1 billion at the end of June 2007 to over €300 billion at the end of 2008. Subsequently, the average amount placed in the deposit facility declined gradually to less than €20 billion by June 2009, but rose again to €190 billion on average during the summer. The Eurosystem also absorbed liquidity through fine-tuning operations in the course of the maintenance period on several occasions in December 2007, January 2008 and October 2008, as well as at the end of most maintenance periods.

As mentioned above, the size of the Federal Reserve's balance sheet did not increase significantly between June 2007 and September 2008, because the excess liquidity provided through the new lending facilities was withdrawn through the sale and redemption of Treasury securities worth around USD 300 billion – this raised the amount of one category of assets and reduced the amount of another. However, this was no longer possible after the massive liquidity injections resulting from the measures implemented in October 2008, when the Federal Reserve reached an agreement with the Treasury, according to which the latter would issue securities and deposit the proceeds in a supplementary account with the Federal Reserve. This measure absorbed USD 500 billion in October and November 2008, with USD 200 billion still outstanding in August 2009.

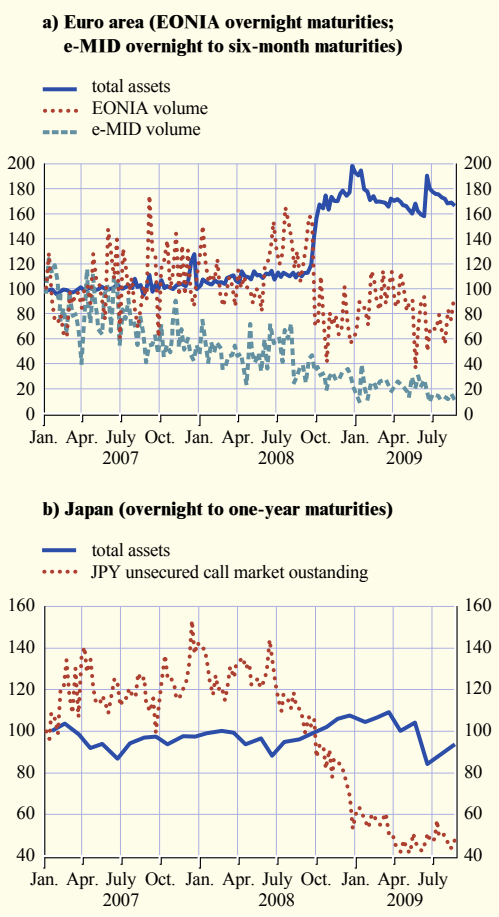
For its part, before November 2008, the Bank of Japan occasionally absorbed liquidity through the sale of Bank of Japan bills and reverse repos of Japanese government securities, the outstanding amounts of which were around JPY 1 trillion at most.

US and Japanese credit institutions' current account balances with their respective central banks, which cover minimum reserve requirements and excess reserves, have also increased since October 2008. This is due to the introduction of the remuneration of excess reserves which has enabled banks to hold excess reserves at no cost. The Federal Reserve began remunerating required and excess reserves in October 2008 and, the following month, the Bank of Japan introduced a temporary Complementary Deposit Facility, which is reported together with the current accounts on the balance sheet, in order to pay interest on excess reserves. These measures became important for the absorption of excess liquidity and led to significant increases in the current accounts – from less than USD 20 billion in June 2007 to USD 860 billion in August 2009 in the case of the Federal Reserve and from less than JPY 10 trillion to JPY 12 trillion in the case of the Bank of Japan.

The massive increases in liquidity provision on the asset side of the balance sheet and liquidity absorption on the liability side show the important role that the central banks played as intermediaries when money markets were not functioning properly, particularly in the months following the collapse of Lehman Brothers in September 2008. By stepping in to relieve the liquidity shortages in October 2008, the central banks partially replaced a large part of the money market as a source of funding for

Chart 3 Central banks' total assets and money market turnover

(January 2007 = 100)



Sources: Eurosystem, e-MID, Bank of Japan, Japanese Brokers Association and ECB calculations.

credit institutions. For example, the volume of trading on the euro interbank overnight market and on the e-MID[2] market dropped when the Eurosystem introduced unlimited refinancing at a fixed rate and reduced the standing facilities corridor to 100 basis points around the interest rate on the MROs (see Chart 3(a)). With a view to reactivating the euro money market, the standing facilities corridor was widened again to 200 basis points at the end of January 2009. Thereafter, it was reduced to 150 basis points in May. As shown in Chart 3(a), overnight volumes increased and the Eurosystem's total assets declined between January and June 2009.[3] The increase in the Bank of Japan's repo operations and excess reserves between October 2008 and July 2009 was also associated with a decrease in money market activity (see Chart 3(b)).[4]

The intermediation role of the central banks, which was particularly important in the months following the collapse of Lehman Brothers, is consistent with the Eurosystem's enhanced credit support programme, the Federal Reserve's credit easing policy and the Bank of Japan's measures to bolster the corporate debt market.

3.3 TRENDS IN AUTONOMOUS FACTORS

During the financial turmoil, the liability side of the simplified balance sheets of the three central banks also grew as a result of the increase in autonomous liquidity factors, in particular euro banknotes, euro area government deposits and US Treasury deposits. The increase in the size of these autonomous factors explains why the liquidity provision by means of monetary policy instruments explained in Section 3.1 increased more than the liquidity absorption explained in Section 3.2. The increase in the size of these autonomous factors was coupled with an increase in their volatility.

The financial turmoil affected demand for banknotes, particularly in the autumn of 2008. Chart 4(a) shows that, in addition to the long-term upward trend and the seasonal increases in the quantity of banknotes in circulation around holiday periods, there was a significant rise in demand for euro banknotes and, to a lesser extent, for US dollar banknotes at the end of September 2008. In the first half of October the above-trend demand for euro banknotes was approximately €35 billion, approximately two-thirds of which was for

2 e-MID is the largest European electronic market for unsecured interbank deposits.

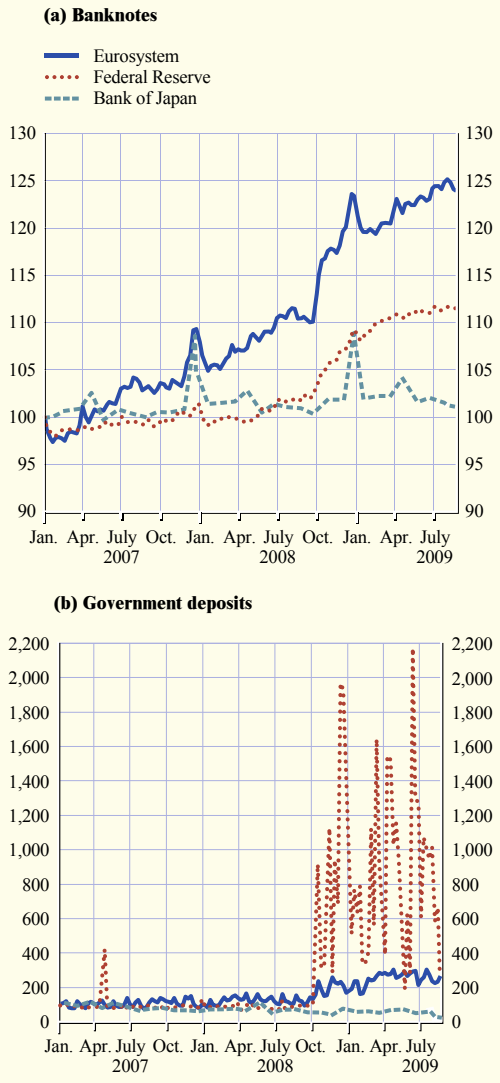
3 For a discussion on the impact of the narrow corridor between the standing facilities on euro overnight markets, see the article entitled "The implementation of monetary policy since August 2007" in the July 2009 issue of the Monthly Bulletin.

4 Data on US dollar overnight trading volumes are not publicly available.

€500 banknotes. Since high-denomination banknotes are usually used as a store of value (i.e. as a substitute for bank deposits) and not for transaction purposes, the high demand may be related to a lack of confidence in the banking system at that time. Moreover, a considerable proportion of the demand for €500 banknotes stemmed from banks located close to the borders of the euro area or from banks that handle the distribution of banknotes in countries outside the euro area, particularly in eastern Europe. This extraordinary demand for euro banknotes tapered off at the end of October 2008 after governments had announced extraordinary measures to support the banking sector. The level of currency in circulation, however, has remained above its long-term trend. Similarly, the growth in the Federal Reserve's banknotes outstanding, which had been decelerating since 2003, rose in May 2008, driven mainly by greater demand from Latin America and, later in the year, from eastern Europe and within the United States.

Chart 4 Autonomous liquidity factors

(January 2007 = 100)



Sources: Eurosystem, Federal Reserve, Bank of Japan and ECB calculations.

The size and volatility of the deposits by euro area governments and the US Treasury with the Eurosystem and the Federal Reserve respectively rose significantly in the last quarter of 2008 (see Chart 4(b)). One reason for this development was the large and varying payments related to various government programmes introduced in response to the financial turmoil. The US government, for example, kept a high balance in its Treasury General Account at the Federal Reserve in order to accommodate outflows related to the Troubled Asset Relief Program. Moreover, Treasury departments found it increasingly difficult to place funds in the market.

Finally, the investment portfolios of the euro area central banks, shown under "domestic assets" on the Eurosystem's simplified balance sheet (see Table 1(a)), have increased since June 2007. Most of this increase in "domestic assets" did not appear in the simplified balance sheet until an accounting reclassification took place at the end of December 2008 (see the box). The increase in euro area central banks' investment portfolios is within the limits stipulated in a Eurosystem agreement that ensures that the investment portfolios held by euro area central banks do not interfere with the single monetary policy. Euro area central banks acquire euro-denominated assets, for example, to boost monetary income, to invest their own funds and to provide agent services to governments (e.g. government pension funds), foreign central banks and foreign governments (e.g. reserve management services).

4 CONCLUSION

In response to the financial turmoil, the Eurosystem, the Federal Reserve and the Bank of Japan introduced significant measures to support the continued access of financial institutions to liquidity, despite the dysfunctioning of money markets, and to reduce the tension in credit markets, and thereby ensure the smooth transmission of monetary policy to the real sector of the economy. These measures turned the central banks into important money market intermediaries and led to considerable increases in the size and complexity of their balance sheets.

Prior to October 2008 the three central banks focused on addressing the dysfunctioning of the money market by increasing the outstanding amounts and/or the average maturity of their refinancing operations. Since October 2008 they have increasingly aimed to support the flow of credit to the private sector and repair the monetary policy transmission mechanism in a broader sense. As the euro area economy depends much more on the banking sector than the US economy does,[5] the Eurosystem has implemented an enhanced credit support programme, emphasising the provision of liquidity to credit institutions, including by means of covered bond purchases. Owing to the economic importance of capital markets in the United States, the Federal Reserve has conducted a credit easing policy, targeting different segments of the credit market. The Bank of Japan has introduced special measures in support of the corporate financing market, which has been particularly hard-hit as a result of the downturn. In addition to the domestic monetary policy measures, the three central banks (and several others) have joined forces in an unprecedented global effort to mitigate the impact of the worst financial turmoil in decades by supplying foreign currency to local banking systems via central bank swap lines.

5 Euro area non-financial corporations obtained an average of 70% of their external financing from banks between 2004 and 2008, while US corporations relied on banks for slightly more than 20% of their financing needs during the same period. For details, see the article entitled "The external financing of households and non-financial corporations: a comparison of the euro area and the United States" in the April 2009 issue of the Monthly Bulletin.