The liquidity management of the ECB

The ECB's liquidity management, i.e. its allotment decisions in open market operations, plays the central role in the implementation of monetary policy in the euro area. Focusing on both the demand for and the supply of liquidity, this article describes the liquidity management of the ECB in the first three years of the euro. In the operational framework of the Eurosystem, the weekly main refinancing operations are the main instrument in liquidity management. The article explains how the ECB estimates credit institutions' liquidity needs and how they constitute a baseline in the ECB's allotment decisions in the main refinancing operations. The article suggests that, overall, the liquidity management of the ECB has facilitated a smooth supply of liquidity and generally managed to keep the short-term money market rates close to the rate of the main refinancing operations.

1   Introduction

Central bank liquidity management comprises assessing the liquidity needs of the banking system and supplying or absorbing the appropriate amount of liquidity through open market operations. In the case of the euro area, credit institutions' liquidity needs mainly arise from two factors. First, the ECB imposes minimum reserve requirements on euro area credit institutions. Second, liquidity needs are created by what are known as autonomous factors, e.g. banknotes in circulation and government balances at central banks.

To place the liquidity management of the ECB in the broader context of monetary policy implementation, it is useful to distinguish the monetary policy strategy from the operational framework. The former describes how the relevant information on the economy is organised to provide a foundation for monetary policy decisions, the outcome of which is a certain level of short-term interest rates that is considered adequate in terms of the ECB's final objective of achieving price stability. The operational framework, by contrast, contains the set of instruments and procedures with which the Eurosystem implements these policy decisions in practice, i.e. with which it steers the short-term market interest rates. Specifically, the desired level of interest rates is signalled to the financial markets through the rates of the main refinancing operations (MROs) and the

standing facilities. So far, the former has been either the minimum bid rate of variable rate tenders or the rate applied to fixed rate tenders. However, setting those rates is not, by itself, sufficient to effectively bring the short-term market interest rates into line with the MRO rate. Indeed, this must also be ensured by the liquidity management of the ECB, through its allotments of MROs and other open market operations.

While previous articles and boxes of the Monthly Bulletin presented some general characteristics of liquidity management and its role in the operational framework of the Eurosystem,[1] the present article goes further in detail and comprehensiveness. In particular, it explains the factors that affect the liquidity needs of the banking system and how a benchmark allotment – an important element in the allotment decision – is derived from those liquidity needs.

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[1]   *See the following articles which have appeared in the ECB's Monthly Bulletin: "The role of the operational framework of the Eurosystem: description and first assessment" (May 1999), "The switch to variable rate tenders in the main refinancing operations" (July 2000) and the box entitled "Autonomous liquidity factors in the euro area and the use of the forecasts of liquidity needs provided by the ECB" in the July 2001 issue. In addition, further information about the operational framework can be found in "The single monetary policy in the euro area: General documentation on Eurosystem monetary policy instruments and procedures" (the "General Documentation"), April 2002, and in the book entitled "The monetary policy of the ECB", 2001.*

2 Overview of the demand for and the supply of liquidity

The demand for and the supply of liquidity and, more generally, the interaction between the Eurosystem's monetary policy operations and the euro area credit institutions, can be illustrated by the consolidated balance sheet of the Eurosystem, which is published on a weekly basis. In the simplified version of the balance sheet presented in Table 1, which constitutes the basis of the subsequent analysis, the ultimate liquidity available to credit institutions is displayed under "Current account holdings – covering the minimum reserve system (L2.1)". The other items can be classified in two broad categories, namely autonomous factors and monetary policy instruments. The "Net foreign assets (A1+A2+A3-L7-L8-L9)" on the asset side, and "Banknotes in circulation (L1)", "Government deposits (L5.1)" and "Other autonomous factors (net)" (a generic term for miscellaneous items) on the liability side, belong to the former category. They are called autonomous factors because they are normally outside the control of the ECB. This is because they are determined either by the behaviour of the public, as in the case of banknotes in circulation, or by institutional arrangements that are not under the control of the liquidity management of the ECB, as in the case of government balances in the accounts of some central banks. By contrast, the remaining

items in the balance sheet (A5.1, A5.2, A5.5, and L2.2) reflect monetary policy instruments.

Taking the current account holdings as a balancing item, an increase in any item on the asset side of the balance sheet is "liquidity providing", meaning that, ceteris paribus, it adds to the liquidity which is available to the banking system. An increase in any liability item other than L2.1, by contrast, leads to an absorption of liquidity from the banking system. The fact that the sum of the autonomous factors is larger on the liability side than on the asset side of the Eurosystem's balance sheet, implies that there is a liquidity deficit of the banking system vis-à-vis the Eurosystem. This means that there is a demand, or a need, for liquidity in the banking system which the ECB has to satisfy via its monetary policy instruments. In the first three years of the euro, the net autonomous factors have accounted for, on average, 45.0% of the overall liquidity needs of the banking system (see Chart 1).

The second major component of the liquidity needs are the minimum reserve requirements imposed on credit institutions by the Eurosystem. It is mainly because of this obligation that the credit institutions' current account holdings with the Eurosystem are

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Table 1

Simplified balance sheet of the Eurosystem (1 March 2002)

(EUR billions; references to the corresponding items in the Eurosystem's weekly financial statement are provided in brackets)

Assets		Liabilities	
Autonomous liquidity factors		**Autonomous liquidity factors**	
Net foreign assets (A1+A2+A3-L7-L8-L9)	387.1	Banknotes in circulation (L1)	285.8
		Government deposits (L5.1)	57.2
		Other autonomous factors (net)	92.1
			435.1
		Current account holdings – covering the minimum reserve system (L2.1)	134.9
Monetary policy instruments		**Monetary policy instruments**	
Main refinancing operations (A5.1)	123.0		
Longer-term refinancing operations (A5.2)	60.0		
Marginal Lending facility (A5.5)	0.0	Deposit facility (L2.2)	0.1
	570.1		**570.1**

relatively high. The minimum reserves, which amount to 2% of certain short-term liability items of the balance sheets of the credit institutions, have accounted for, on average, 54.3% of their liquidity needs.

Finally, a very small, though at the margin still important, part of the current account holdings does not contribute to the fulfilment of the reserve requirements and is called excess reserves.[2] These are current account holdings of credit institutions which have already fulfilled their reserve requirements or which do not have to fulfil such requirements because they are so small that they fall under the lump-sum allowance of €100,000. Contrary to the required reserves, excess reserves are not remunerated. They accounted for around 0.4% of total liquidity needs in the first three years of the euro.

To satisfy the liquidity needs arising from the three sources described above, the Eurosystem provides liquidity to the banking system on a regular basis. The bulk of credit institutions' liquidity needs, on average 73.5%, has been met through the regular main refinancing operations (MROs), i.e. item A5.1 in the balance sheet. These operations play the main role in steering short-term interest rates, managing the liquidity situation in the market and signalling the stance of monetary policy. They are liquidity-providing, reverse operations with a maturity of two weeks, and they are executed once a week through a tender procedure. The monetary policy stance of the Eurosystem is currently signalled through the minimum bid rate set for these tenders. Before the introduction of the variable rate tender in June 2000, the signalling role was performed by the rate applied to the fixed rate tenders.

Another regular source of refinancing is to be found in the longer-term refinancing operations (LTROs), item A5.2, which are conducted once a month and have a maturity of three months. However, the intended size of LTROs is fixed in advance by the Governing Council of the ECB, and therefore these operations do not play an active role in

Chart I

The main liquidity components of the Eurosystem balance sheet
(averages per maintenance period in EUR billions)
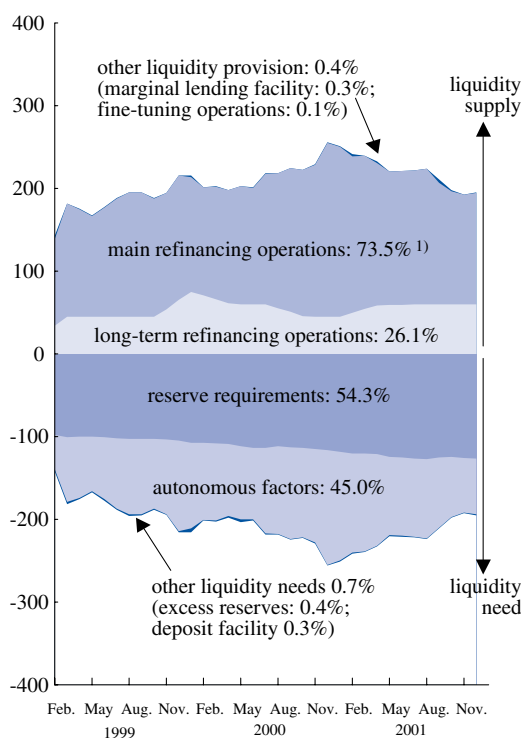
Source: ECB.
1) *Includes the tender split operations conducted in May 2001 and December 2001.*

the ECB's liquidity management. Currently, the aim is that the LTROs would satisfy around a quarter of credit institutions' liquidity needs, which, indeed, is close to their actual share of 26.1% in the period from 1999 to 2001. In addition, around 0.1% of the liquidity needs have been met through fine-tuning operations. These have mainly been related to exceptional events such as the millennium changeover and the terrorist attacks on 11 September 2001.

Finally, the residual liquidity imbalances of the banking system can be absorbed through

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2   *In the case of some central banks outside the Eurosystem, "excess reserves" refers to all central bank deposits which banks may hold in excess of the required reserves. However, in the operational framework of the Eurosystem, a major part of such deposits is placed in the deposit facility which some other central banks do not have. Therefore, it is important to note that here "excess reserves" has a much narrower meaning than in the case of some other central banks.*

recourse to either of the two standing facilities, the marginal lending facility and the deposit facility (A5.5 and L2.2, respectively). These can be accessed by counterparties as they deem necessary on each TARGET operating day in order to obtain funds against adequate collateral (through the marginal lending facility) or to deposit funds (on the deposit facility), both with an overnight maturity. The standing facilities also signal the stance of monetary policy by setting an upper and a lower limit, or "corridor", for the movements of the overnight rate. This corridor has been symmetric around the MRO rate since 9 April 1999. On average, only around 0.3% of the liquidity supplied by the ECB has been placed on the deposit facility and an equivalent amount of the total liquidity needs has been satisfied via the marginal lending facility. Consequently the net provision of liquidity through the standing facilities has, on average, been zero.

3 The liquidity needs of the euro area credit institutions

In order to adequately adjust the liquidity supply to the liquidity needs via the weekly MROs, the ECB needs accurate forecasts of the future development of the autonomous factors as well as of the average size of the reserve requirements and the excess reserves. This section presents some further features of these three categories of liquidity needs.

Autonomous factors

The short-term developments of the autonomous factors constitute by far the largest source of uncertainty about the liquidity needs of the euro area. In order to alleviate the impact this has on counterparties' bidding behaviour, the ECB publishes, each time an MRO is announced, a forecast of the average autonomous factors up to the day preceding the settlement of the subsequent MRO. Internally, the Eurosystem produces separate forecasts for all the main autonomous factors: the national central banks transmit forecasts of the development of their respective national autonomous factors to the ECB on a daily basis, which then integrates them into an aggregated euro area liquidity forecast. Chart 2 summarises, over three different time horizons – namely the same day, five and ten business days ahead – information on the quality of the Eurosystem's daily forecasts of autonomous factors. It shows the average absolute values of the actual changes and the forecast errors for both the t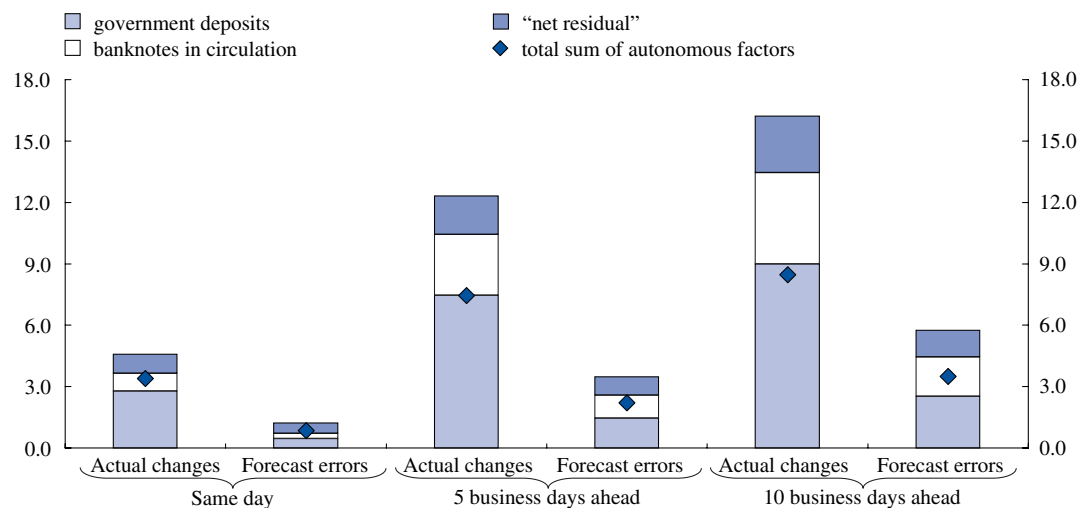otal sum of autonomous factors and three individual factors, namely government deposits, banknotes in circulation and the "net residual", which is defined as other autonomous factors minus net foreign assets (see Table 1). The average change and the average forecast error of the sum of the autonomous factors are less than the sum of the averages for the individual factors because of netting, i.e. positive changes in one factor can be offset by negative changes in another.

As will be explained in further detail in the next section, the horizons of up to five business days ahead are normally the most relevant for the ECB's allotment decisions. For the period from January to November 2001, the average forecast error of the sum of all autonomous factors, over the horizons of same day and five business days, amounts to around €0.8 billion and €2.2 billion respectively. This means that the errors account for up to 25% and 30% respectively of the average actual changes of the autonomous factors, which are €3.4 billion and €7.5 billion respectively. The ability of the Eurosystem to forecast more than 70% of the variability of the total autonomous factors over shorter horizons mainly stems from its privileged information about its own financial transactions and, more importantly, about the financial transactions of the public sector. Especially in Italy, but also in France, Greece and Spain, these transactions affect the government deposits, which, also when aggregated at the Eurosystem level, are by far the most volatile autonomous factor (see Chart 2). Even

Chart 2

The average actual changes and the Eurosystem's average forecast errors of individual and total autonomous factors from January 2001 to November 2001

(averages in EUR billions)

- government deposits
- banknotes in circulation
- "net residual"
- ◆ total sum of autonomous factors

Actual changes | Forecast errors
Same day

Actual changes | Forecast errors
5 business days ahead

Actual changes | Forecast errors
10 business days ahead

Source: ECB.

though the national central banks can forecast correctly around 80% of the changes in government deposits over the short-term horizons, government deposits are still the most important source of forecast errors. In addition, the forecast errors of banknotes in circulation were unusually high in the second half of 2001 and, in particular, at the beginning of 2002 because of the cash changeover.

Reserve requirements

The size of the reserve requirements can be estimated with high precision at the start of each maintenance period. The reserve base used to calculate the reserve requirements is given by the ECB's money and banking statistics (which are also used to calculate M3). The first estimate of the reserve requirements is normally published a few days after the start of each maintenance period, immediately after the publication of M3.

The minimum reserve system of the Eurosystem, which has a monthly averaging provision, primarily pursues the aims of

stabilising money market interest rates and enlarging the structural liquidity shortage of the banking system. In particular, the averaging mechanism means that counterparties' minimum reserve holdings are calculated as an average over the whole one-month maintenance period, instead of on each individual day. Due to the sufficiently high level of reserve requirements in the euro area, this has implied that temporary liquidity shocks arising from autonomous factors have not normally led to significant changes in the overnight rate. In other words, counterparties have, in the aggregate, been willing in most cases to compensate for higher (lower) current account holdings on a particular day with correspondingly lower (higher) holdings on subsequent days, without requiring noteworthy premiums which could have affected the overnight rate. Therefore, only on those days when market participants expected an accumulated liquidity imbalance, i.e. a mismatch between the liquidity supply and liquidity needs over the whole maintenance period, has there been a notable impact on the overnight rate. Especially after the last MRO of the maintenance period, but also after an

The average daily excess reserves per maintenance period

(daily averages per maintenance period in EUR billions)

— realised daily averages
······ estimated daily averages
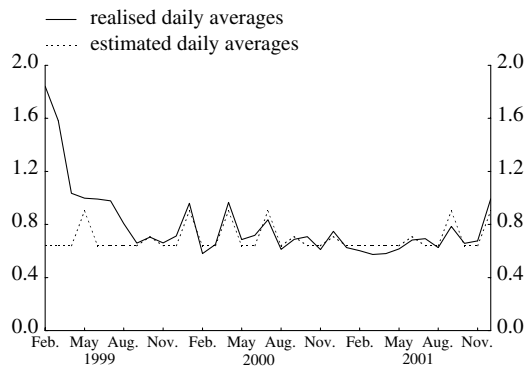
occurrence of underbidding earlier in the same maintenance period,[3] expectations, and ultimately realisations, of such accumulated liquidity imbalances seem to have generally caused significant movements in the overnight rate.

Excess reserves

Since excess reserves, i.e. reserves held in excess of reserve requirements, are not remunerated and since they could, in principle, be transferred to the remunerated deposit facility or preferably even lent out in the overnight interbank market, they represent a cost for credit institutions. This should, however, be seen as balancing some of the benefits for credit institutions, which mainly consist of avoiding various transaction

costs. These include both the direct costs incurred by credit institutions in accessing the overnight market or the deposit facility, as well in obtaining sufficiently precise information on their liquidity position at the end of the day. Uncertainty, for instance, regarding late payments implies a cost of "staying late in the office" to make sure that all funds held in current accounts with the Eurosystem in excess of the required reserves are actually transferred to the deposit facility. Furthermore, especially at the end of the maintenance period, excess reserves can also be seen as buffers against risks of unforeseen non-compliance with the minimum reserve obligations.

Excess reserves tend to be higher when the maintenance period ends on a weekend, probably in connection with the transaction costs mentioned above. The dotted line in Chart 3 shows estimates of average daily excess reserves per maintenance period obtained on the basis of the following assumption: average daily excess reserves amount to €640 million when the maintenance period ends on a weekday, €710 million when it ends on a Saturday and €900 million when it ends on a Sunday. Although excess reserves were somewhat higher at the beginning of 1999, as counterparties needed to build up experience with the minimum reserve system, Chart 3 shows that this very simple forecasting approach appears to have resulted in reasonable estimates.

4 The supply of liquidity

The assessment of the liquidity needs of the banking system described in the previous section is a key element for the liquidity allotments in the open market operations of the Eurosystem. Specifically, by making some further assumptions, described below, regarding the allocation of liquidity needs to each of the MROs within a maintenance period, a so-called benchmark allotment can be calculated on the basis of these liquidity needs. This benchmark constitutes a baseline

for the ECB when making its actual allotment decisions. However, the ECB may sometimes also have to consider other elements, such as counterparties' bidding behaviour in the MROs and the divergence of the short-term money market interest rates from the MRO

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3   The term underbidding refers to MROs in which the Eurosystem did not receive sufficient bids in order to allot the benchmark allotment, which is defined in Section 4. Conversely overbidding refers to those MROs where disproportionately large bids were submitted.

rate, as well as some exceptional factors creating very high uncertainty about liquidity forecasts, such as the transition to the new millennium, the cash changeover, etc.

In the benchmark allotment, the liquidity needs arising from autonomous factors and minimum reserve requirements are taken into account, so that reserve requirements are fulfilled, on aggregate, smoothly (i.e. proportionally over time) over the maintenance period. Although other approaches could also be considered, a smooth fulfilment of reserve requirements is attractive since it normally enhances the buffer function of reserve holdings against unexpected liquidity shocks. Indeed, if some counterparties' reserve holdings were to be too low on some days, they might be insufficient to serve as a buffer against unforeseen payments, possibly occurring too late to be offset in the money markets. Furthermore, risk-averse credit institutions may themselves have a preference for spreading reserve holdings evenly across the whole reserve maintenance period, in order to minimise the liquidity and interest rate risks involved. Finally, in most cases, a smooth fulfilment fully exploits the ability of each MRO in a given maintenance period to supply liquidity.

On any given day during the maintenance period, liquidity needs also depend on whether or not the fulfilment of the reserve requirements during the preceding days of the period has been entirely smooth. For instance, some excess or deficient liquidity can accumulate on account of errors in forecasts of autonomous factors and, in particular, in the first few days of a maintenance period before the first MRO is settled, because the liquidity needs on these days are usually not taken into account in the previous allotment decision (see below). In general, when calculating the benchmark allotment, the ECB takes into account the liquidity imbalance that has accumulated since the beginning of the relevant maintenance period in order to return to a smooth fulfilment of reserve requirements.

Liquidity needs arising from excess reserves likewise cannot be easily attributed to one or the other day within the reserve maintenance period. To the extent to which excess reserves reflect liquidity buffers held by counterparties on top of their reserve obligations on each day of the reserve maintenance period, the implied liquidity needs would be constant throughout the maintenance period. However, insofar as excess reserves are caused by counterparties who have already fulfilled their reserve requirements, they only give rise to significant liquidity needs in the last few days of the maintenance period, when the likelihood of actually having fulfilled the reserve requirements increases. For the sake of simplicity, the ECB has thus far based its calculation of the benchmark allotment on the assumption that excess reserves are built up smoothly over the reserve maintenance period.

Finally, the time period over which liquidity needs are calculated when deciding on the allotment amount generally extends to the day before the settlement of the subsequent MRO, when the ECB has the next opportunity to change the liquidity supply via the regular open market operations. However, in the last MRO of a maintenance period, when this horizon usually ranges into the next maintenance period, only the days remaining until the end of the current maintenance period are counted.

The annex provides a detailed formula on how to calculate the benchmark allotments, shown in Chart 4, on the basis of the key liquidity figures, made available by the ECB via wire services. These include the forecast of the aggregated reserve requirements of the banking system and of the average of the autonomous factors. For the period before the introduction of the variable rate tender in June 2000, when the ECB did not publish an autonomous factors forecast, the benchmark allotments in Chart 4 have been calculated against the ECB's internal forecasts. The only piece of information which is not provided by the ECB but which is needed to

calculate the benchmark allotment is an estimate of the excess reserves and, in the first few days of the maintenance period, the reserve requirements. The former, however, can be estimated with a satisfactory degree of precision via the model presented in Section 3, while the level from the previous maintenance period normally constitutes a fairly good estimate for the reserve requirements (Chart 1 illustrates the rather stable evolution of the required reserves).

Chart 4 indicates that the actual allotment amounts have generally been rather close to the benchmark. However, Chart 5 shows that, on some occasions, important deviations have taken place. Disregarding the first two maintenance periods after the launch of the euro, the largest positive (i.e. liquidity-providing) deviation occurred as a consequence of the transition to the new millennium in the MRO allotted on 30 December 1999. The largest negative

difference occurred in the MRO allotted on 6 November 2001, when the ECB could not allot the benchmark amount due to underbidding. Chart 5 also shows that the ECB often engineered relatively loose liquidity conditions during the intensive phase of overbidding in the second half of 1999 and the first half of 2000, and that, in all but the very first underbidding event, the ECB only partially offset the resulting liquidity deficits.

Furthermore, it is important to note that the benchmark allotment calculated on the basis of the forecast of the autonomous factors published on the announcement day, as described in the annex, may be slightly different from the actual benchmark allotment calculated by the ECB on the allotment day. This reflects the fact that the ECB updates its liquidity forecasts on the allotment day, which is normally the day after the announcement day. Chart 5 shows that a small part (on average, around 10%) of the deviation from

The actual and the benchmark allotments[1]

(weekly data; EUR billions)

― benchmark allotment (calculated as per the announcement day)
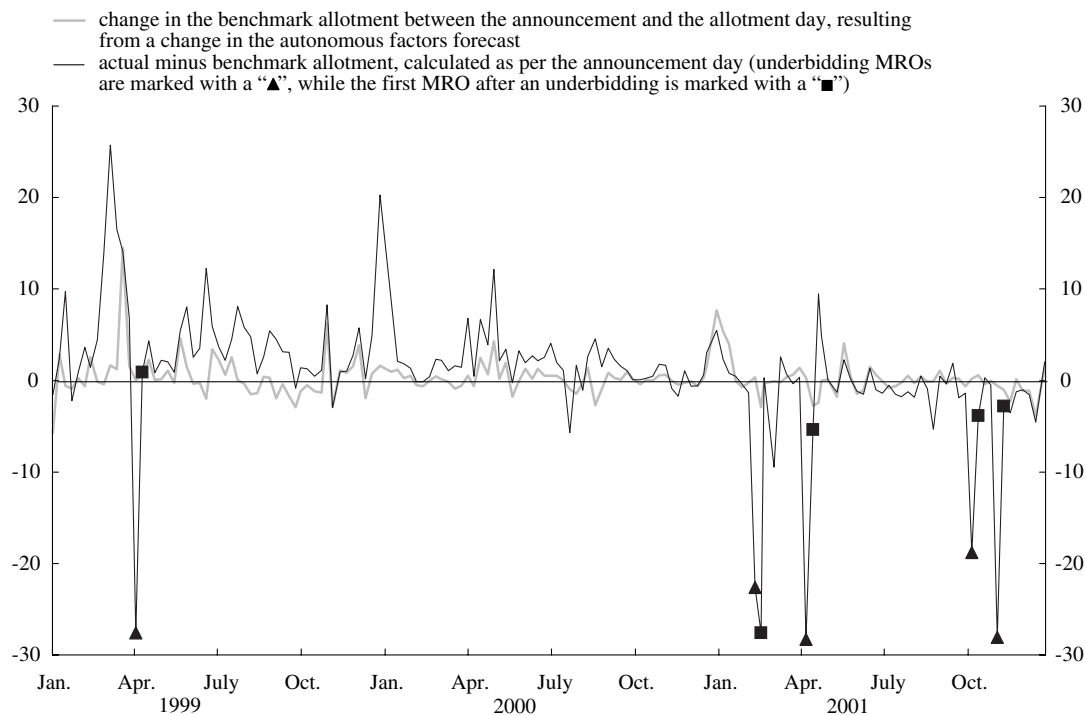― actual allotment
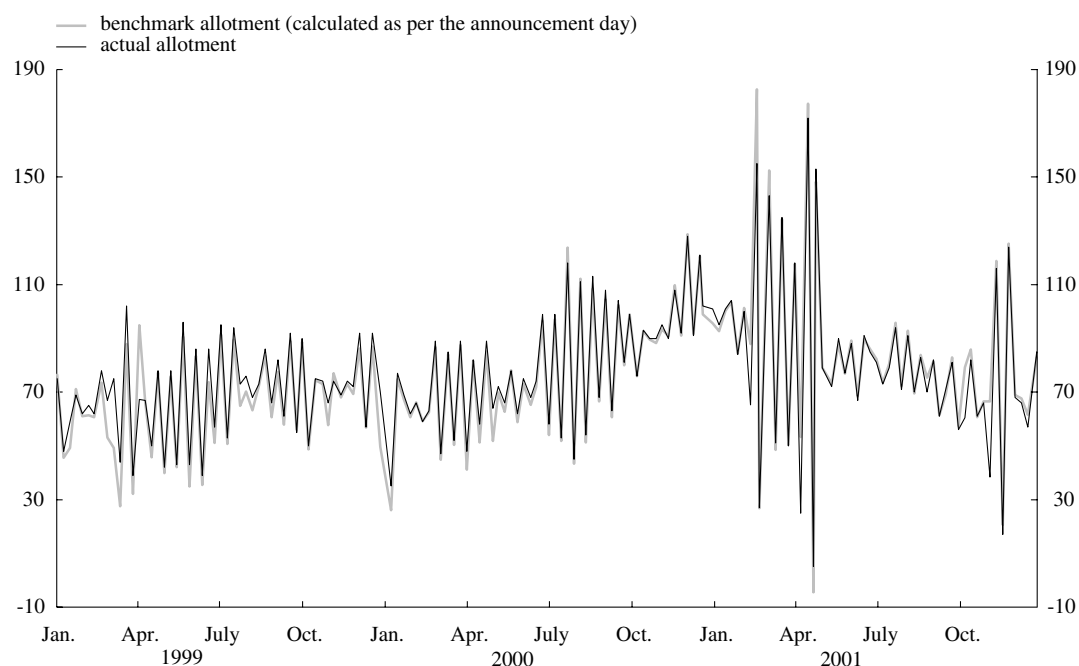
Source: ECB.
1)   On the two days (27 April 2001 and 27 November 2001) on which what are known as "split operations" were carried out, the amounts refer to the sum of the one and the two-week tranches.

Chart 5

The difference between the actual and the benchmark allotments

(weekly data; EUR billions)

— change in the benchmark allotment between the announcement and the allotment day, resulting from a change in the autonomous factors forecast

— actual minus benchmark allotment, calculated as per the announcement day (underbidding MROs are marked with a "▲", while the first MRO after an underbidding is marked with a "■")

Source: ECB.

the benchmark allotment calculated on the basis of the published forecast of the autonomous factors on the announcement day can be explained by the ECB's update of this forecast on the allotment day. So far, the ECB has only once published an updated forecast on the allotment day of an MRO, namely on 18 December 2001, when the forecast deviated substantially from that published on the day before, due to banknotes in circulation in connection with the cash changeover.

In the article entitled "Bidding behaviour of counterparties in the Eurosystem's regular open market operations" in the October 2001 issue of the ECB's Monthly Bulletin, it was illustrated that counterparties tend to concentrate their bids around one single level of interest rates in each MRO. This concentration implies that the marginal rate of a specific MRO is normally very inelastic with respect to the allotment amount and, hence, that even large deviations from the

benchmark allotment would not normally imply any significant changes to the marginal rate. Indeed, in the 79 MROs conducted as variable rate tenders by December 2001, the demand schedule was such that it would have been necessary to decrease the allotment amount, on average, by €24 billion in order to increase the marginal rate by one basis point. Similarly, when omitting the 21 tenders in which the marginal rate was equal to the minimum bid rate, and could thus not, by definition, be decreased, the allotment amount should have been increased, on average, by €14 billion in order to reduce the marginal rate by one basis point. Normally, the only likely effect of a substantial deviation from the benchmark allotment would be an indirect one, as it would usually lead to expectations that the ECB may be favouring either tight or loose liquidity conditions for the end of the relevant maintenance period as well. This could have an impact on the day-to-day interest rates, as explained in Section 3.

5 The use of the standing facilities

While the Eurosystem normally aims at satisfying the liquidity needs via its open market operations, liquidity shocks, especially after the last MRO of a maintenance period, may force the banking system as a whole to take recourse to the standing facilities. The recourse to the standing facilities caused by actual or expected liquidity imbalances at the level of the whole euro area, i.e. imbalances between the liquidity supplied by the ECB and the liquidity needs of the banking system over a given maintenance period, is labelled "aggregate recourse". The aggregate recourse can be seen as a result of either a liquidity forecast error or of a deliberate deviation from the benchmark allotment by the ECB. Normally, the aggregate recourse takes place only towards the end of a maintenance period, when the banking system must ultimately compensate for any accumulated aggregate liquidity imbalance via the standing facilities. In "loose" maintenance periods, i.e. those with an accumulated liquidity surplus, credit institutions place any excess holdings in the deposit facility in order to obtain some remuneration. By
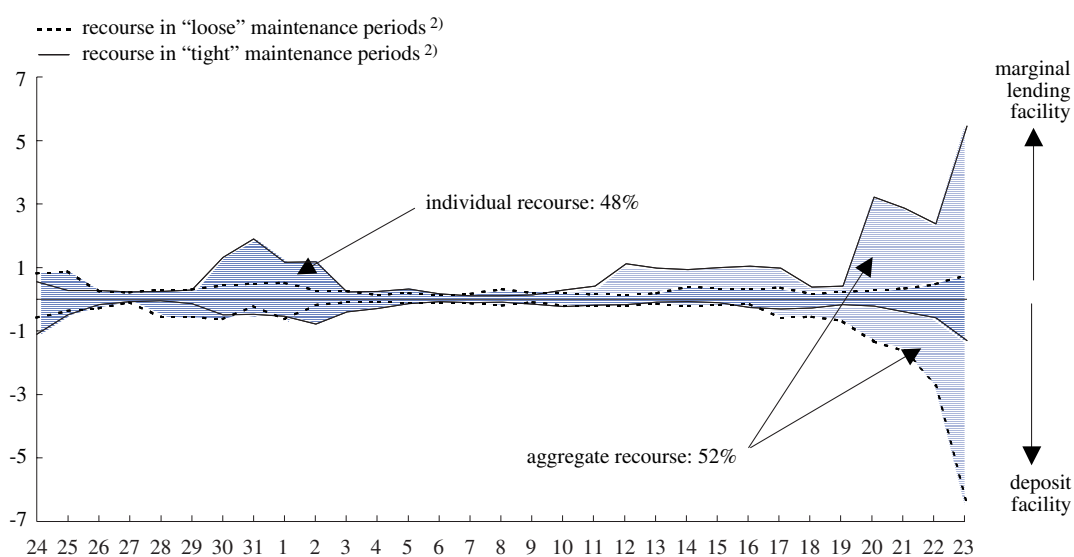
contrast, in "tight" maintenance periods, i.e. those with an accumulated deficit, they take recourse to the marginal lending facility in order to fulfil the reserve obligations and hence avoid the penalties associated with an underfulfilment. However, market participants may also expect the end of the maintenance period to be either "loose" or "tight". Such expectations, if sufficiently strong, may imply that some of the aggregate recourse to standing facilities actually takes place even before the last trading day of the maintenance period, as was the case, for instance, during the maintenance period ending on 23 April 2001. It will be assumed below, however, that the aggregate recourse is always zero in the first half of a maintenance period, when the conditions expected for the end of the maintenance period are normally so uncertain that no use of the standing facilities can be expected.

A different type of recourse to standing facilities, referred to here as the "individual recourse", is normally spread rather evenly

Chart 6

Average recourse to the standing facilities in the course of a maintenance period [1]

(averages per calender day, calculated over the period from 24 February 1999 to 31 December 2001; EUR billions)

- - - - recourse in "loose" maintenance periods [2]
——— recourse in "tight" maintenance periods [2]

individual recourse: 48%

aggregate recourse: 52%

marginal lending facility

deposit facility

24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
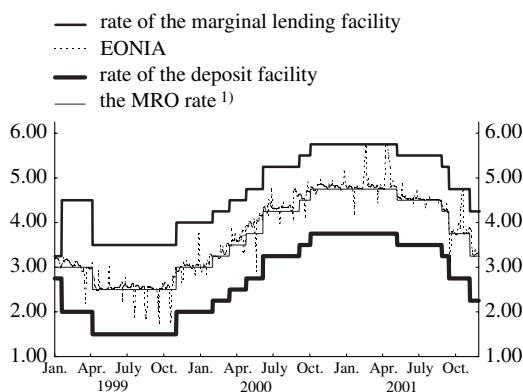
Source: ECB.
1) *The lines show the average recourse in "tight" and "loose" maintenance periods, while the shaded areas illustrate how the aggregate and the individual recourse can be measured, as explained in the text.*
2) *"Tight" and "loose" maintenance periods are distinguished here via the accumulated net recourse after the settlement of the last MRO.*

along the maintenance period. This is caused solely by an inadequate distribution of liquidity across credit institutions, typically at the end of the day, when money markets are no longer liquid.

It follows from the above that all the recourse to the standing facilities in the first half of each maintenance period, the average recourse to the marginal lending facility in the second half of "loose" maintenance periods and the average recourse to the deposit facility in the second half of "tight" maintenance periods must reflect an individual liquidity imbalance (the dark shaded area in Chart 6). By contrast, all the average recourse to standing facilities in excess of this individual recourse can be qualified as aggregate (the light shaded area in Chart 6). On the basis of this reasoning, the aggregate and individual recourse up to December 2001 each accounted, on average, for around half of the overall recourse to the standing facilities. Hence, only half of the 0.3% of the overall liquidity supply/demand stemming from the use of the standing facilities reflected aggregate recourse, and thus a euro area-wide liquidity need or surplus. This further confirms that allotments close to the benchmark have thus far been predominant and that forecast errors in autonomous factors have not had too strong an impact on liquidity conditions in the euro area. These aspects, together with the ability of the averaging mechanism to absorb temporary liquidity shocks (see Section 3), have meant that deviations of the overnight rate from the MRO rate were generally rather modest in the period from January 1999 to December 2001. In this period, the average absolute spread between the MRO rate and the EONIA – an effective overnight rate computed as the weighted average of 49 panel banks' unsecured lending in the euro overnight interbank market – amounts to only

The EONIA and key ECB interest rates

(daily data in percentages)

— rate of the marginal lending facility
······ EONIA
— rate of the deposit facility
— the MRO rate [1]

1) *i.e. the rate applied to the fixed rate tenders and the minimum bid rate of the variable rate tenders.*

14 basis points (see Chart 7). This number decreases even further, to 10 basis points, if one excludes the rather volatile days after the last MRO of a maintenance period as well as the days following an occurrence of underbidding.

The average individual recourse of €300 million per day to either of the standing facilities (see Chart 6) is also rather modest. Compared, for instance, with the daily average volume of unsecured overnight lending of around €42 billion reported by the EONIA-panel banks, it shows clearly that only a marginal amount of liquidity imbalances is compensated via the standing facilities. This, in turn, suggests that the cost of using the standing facilities has been sufficiently high to ensure that they do not undermine an active interbank market for liquidity. Still, the corridor set by the standing facilities has also successfully limited the variability of the overnight rate. Even under exceptional circumstances, such as the millennium changeover or after extreme tightness following underbidding, the EONIA has never moved outside the corridor (see Chart 7).

6 Concluding remarks

Four conclusions can be drawn from the analysis presented in this article.

First, the ECB has aimed, all in all, at satisfying credit institutions' liquidity needs in a smooth and predictable way over the reserve maintenance period, given that the actual allotment amounts in the MRO's have been set on the basis of a benchmark which the counterparties can, in principle, calculate themselves.

Second, mainly because of the averaging provision of the minimum reserve system and the quality of the Eurosystem's liquidity forecasts, there has been very little need to conduct fine-tuning operations.

Third, related to the above, only a very small fraction of credit institutions' liquidity needs have been met through recourse to standing facilities, implying that the money market has worked efficiently.

Finally, but perhaps most importantly, the small and fairly stable spread between the ECB's MRO rate and the short-term money market rates confirms the precision of the ECB's steering of short-term interest rates.

Benchmark allotment rule normally applied by the ECB in its main refinancing operations

This annex outlines how to calculate precisely the benchmark allotment amount of a main refinancing operation (MRO) on the basis of the information available on the announcement day, which is normally one business day prior to the allotment day.

In the following, MRO^{bench} denotes the MRO for which the benchmark allotment is to be calculated, while its settlement day and its announcement day are represented by S and A respectively. Furthermore, Z is the day before the settlement of the subsequent MRO, referred to as MRO^{sub}, T the last day of the prevailing maintenance period and H the number of days covered by the forecast of the autonomous factors made available by the ECB on the announcement day. If, at the end of a maintenance period, the ECB makes two forecasts of the autonomous factors available, the relevant one here is the forecast covering the maintenance period in which MRO^{bench} is settled.[1] In the large majority of cases, where MRO^{bench} is announced on a Monday and MRO^{sub} is settled on the Wednesday of the following week, with the latter falling within the same maintenance period (MP), H is 9. More generally, however, taking account also of the last MRO of the period and irregular settlement days caused by bank holidays, H is calculated according to the following rules:

$$\text{If } S \leq T \text{ (i.e. settlement in prevailing MP) then} \begin{cases} \text{If } T > Z \text{ (i.e. not last MRO of MP) then } H = Z - A + 1 \\ \\ \text{If } T \leq Z \text{ (i.e. last MRO of MP) then } H = T - A + 1 \end{cases}$$

If $S > T$ (i.e. settlement in next MP) then $H = Z - T$

In addition, X denotes the number of days covered by H on which MRO^{bench} has not yet been settled (normally X equals 2). RR and ER represent the estimated daily average reserve requirements and the excess reserves, respectively, of the maintenance period in which MRO^{bench} is settled. $\overline{CA}$ is the average current account holdings that have been realised on day A-1 (i.e. the day before the announcement) since the beginning of the maintenance period in which MRO^{bench} is settled. The number of days from the start of the maintenance period until day A-1 is denoted by D. $\overline{AF}$ is the estimated average amount of the autonomous factors made available by the ECB, while L is the expected daily average amount of liquidity supplied via the LTROs, both defined over the H-day period. Finally, M^{mat} denotes the size of the maturing MRO and M^{out} the size of the other outstanding MRO. The benchmark allotment, M^{bench}, which allows for a smooth fulfilment of the reserve requirements can then be calculated as:

$$M^{bench} = \frac{1}{H-X}\left[\underbrace{D \cdot \left(RR + ER - \overline{CA}\right)}_{\text{Accumulated liquidity imbalance}} + \underbrace{H \cdot \left(\overline{AF} + RR + ER\right)}_{\text{Future liquidity needs}} - \underbrace{H \cdot \left(L + M^{out}\right) - X \cdot M^{mat}}_{\text{Liquidity already provided}} \right]$$

If we take the MRO announced on Monday, 4 March 2002, as an example, the benchmark allotment could have been calculated in the following way by inserting both the information available on wire services on that day and a forecast of excess reserves of €0.71 billion (see Section 3):

$$M^{bench} = \frac{1}{9-2}\left[\underbrace{8 \cdot \left(131.2 + 0.71 - 128.7\right)}_{\text{Accumulated liquidity imbalance}} + \underbrace{9 \cdot \left(44.5 + 131.2 + 0.71\right)}_{\text{Future liquidity needs}} - \underbrace{9 \cdot \left(60 + 51\right) - 2 \cdot 72}_{\text{Liquidity already provided}} \right] = 67.2$$

In this MRO the ECB did, indeed, choose to allot the benchmark amount of €67 billion.

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1   *If Z does not fall in the prevailing maintenance period, i.e. the maintenance period in which MRO^{bench} is announced, the ECB splits the forecast of the average autonomous factors for the period A to Z into two: one for the period ranging from A to the end of the prevailing maintenance period, and another for the following days up to Z. However, the estimate for the prevailing maintenance period is only relevant for counterparties' preparation of bids in MRO^{bench} if MRO^{bench} is also settled in this period. Hence, only in this case will both estimates be published.*