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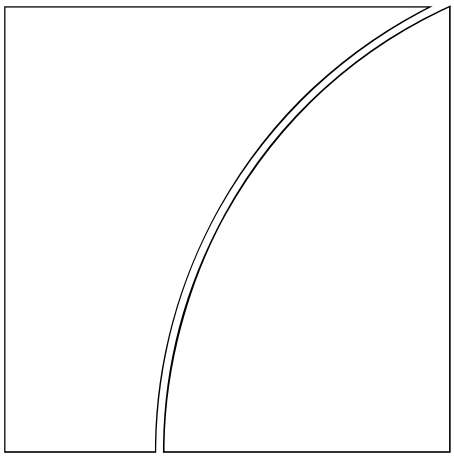

BIS Papers

No 9

Comparing monetary policy operating procedures across the United States, Japan and the euro area

Monetary and Economic Department

December 2001

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

ISSN 1609-0381

ISBN 92-9131-631-8

Foreword

In this volume, the BIS is publishing two papers examining in detail monetary policy operating procedures in the Unites States, Japan and the euro area. These two papers were originally presented at a conference hosted by the European Central Bank entitled "The Operational Framework of the Eurosystem and Financial Markets" on 5-6 May 2000.[1] They have been updated in order to take into account the main changes in the implementation frameworks occurring since then.

While an extensive academic literature exists on monetary policy objectives, strategy and tactics, comparatively little attention has been given to the "nuts and bolts" of policy implementation. This subject has remained the preserve of a relatively small group of cognoscenti, mostly limited to central bankers and some market participants. Likewise, there is a great dearth of comparative material. In many ways, this is regrettable. For, understanding how day-to-day monetary policy is implemented can cast light on a number of important economic questions, not least on the source of central banks' power to set interest rates, and the peculiar features of the market for central bank reserves, from which that power arises.

The two papers in this volume help to fill this gap. They can be seen as updating the material contained in a previous BIS volume,[2] prepared at the time when the euro had not yet been established. In the first paper, Borio provides a general conceptual framework to classify and understand monetary policy operations. He then uses it to highlight similarities and differences between the set ups in the three currency areas. The implications of the various choices made and the possible factors underlying them are analysed against the background of the evolution of the systems. In the second paper, Blenck, Hasko, Hilton and Masaki delve into the subject further, making an exhaustive comparison of the characteristics of the three frameworks considered.

This volume could be of interest to three types of audiences. Central bankers will find in it the most authoritative description of operating procedures in the three main currency areas. They could use the information as a possible benchmark for evaluating the features of their own systems. Market participants could discover valuable information to read more accurately the day-to-day behaviour of the central banks concerned. Finally, the curiosity of academics may be whetted by the attempt to bridge the gap between their own traditional reference framework and the perspective of those who are actually in charge of implementing policy. A common language is a first necessary step towards a common understanding.

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[1] The details of the conference can be found at the back of the volume.

[2] See BIS Conference Paper No 3 on "Implementation and tactics of monetary policy", March 1997.

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A hundred ways to skin a cat: comparing monetary policy operating procedures in the United States, Japan and the euro area[1]

C E V Borio, Bank for International Settlements, Basel

Introduction

I have been kindly invited to provide a "critical" comparative analysis of the monetary policy operating frameworks in the United States, Japan and the euro area (EMU). At the risk of disappointing the audience and readers, let me state from the beginning that it is generally not easy, and often not even appropriate, to be critical in this field of monetary policy. Just as there are a hundred ways to skin a cat, so there are a hundred ways to implement monetary policy. These may differ considerably in terms of the interest rates that are the focus of policy, the range of instruments employed, the frequency of operations, the spectrum of counterparties and other technical elements. Such differences reflect a mixture of purely historical factors and different views regarding the fine balance between the pros and cons of the various choices. At the end of the day, however, the proof of the pudding is in the eating. The "eating" here is the central bank's ability to convey its policy signals with the desired degree of clarity and its ability to influence short-term rates with the desired degree of accuracy. From this perspective, the three frameworks do the job.

What follows, therefore, highlights the key similarities and differences between the three operating frameworks, explaining the implications of the various choices made by the monetary authorities and the possible factors underlying them against the background of the evolution of the different systems. Where relevant, the experience of other central banks, in some cases the predecessors of the European System of Central Banks (ESCB), is brought to bear. Section I outlines a general framework underlying the analysis.[2] Section II attempts a comparative assessment, focusing only on some of the most salient characteristics of the arrangements. The conclusions briefly summarise the key points.

I. Conceptual underpinnings[3]

Operating procedures and the monetary policy framework

What is meant precisely by monetary policy operating procedures? And how do they fit into the overall policy framework? Graph 1 sheds some light on these questions, distinguishing between the strategic and tactical levels of the pursuit of the monetary authorities' policy goals.

Monetary authorities have the responsibility for achieving certain *goals* or *final objectives*. Their macroeconomic goals may be variously defined to include items such as long-term growth or employment. In recent years, however, mandates have de jure or de facto been increasingly focused on "price stability", in some cases even going as far as setting numerical inflation targets to be attained over specific time horizons.

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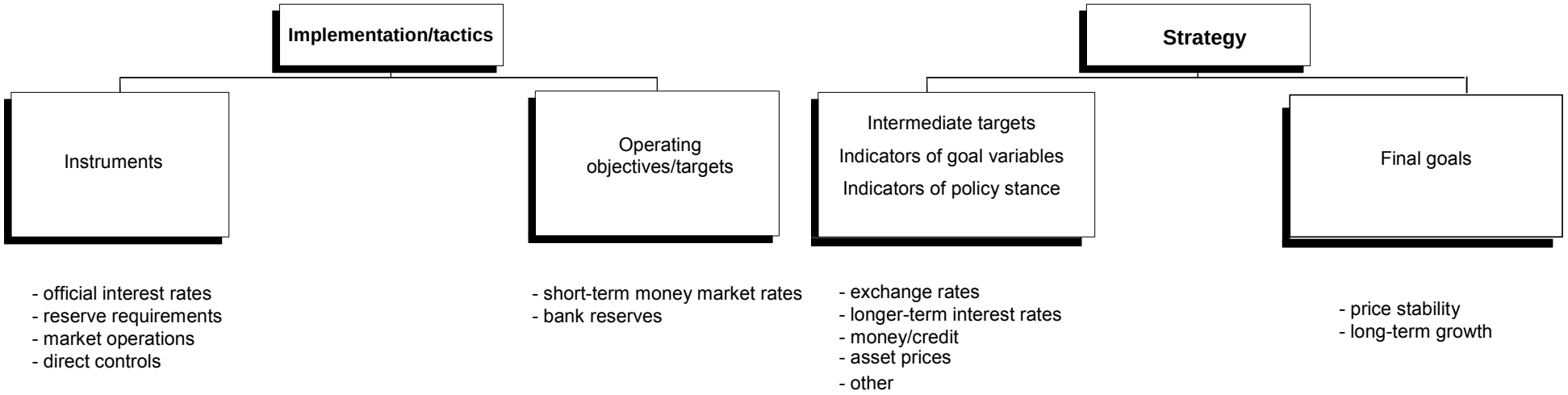
[1] Paper prepared for the ECB Conference on "The Operational Framework of the Eurosystem and Financial Markets", Frankfurt, 5-6 May 2000. I would like to thank Atsushi Miyanoya, Denis Blenck, Spence Hilton and Sandy Krieger for very useful comments, and staff at the respective central banks as well as Willi Fritz for their statistical input. Any remaining errors are my sole responsibility.

[2] This section could be skipped by those already familiar with the field.

[3] This section draws heavily on C E V Borio (1997), "The implementation of monetary policy in industrial countries: a survey", *BIS Economic Paper*, no 47, July.

Graph 1
The monetary policy framework



At the *strategic* level, the pursuit of the final goals rests on a series of choices regarding the information set used as a basis for short-term and longer-term policy adjustments, including the weight and specific role attached to various economic variables. This subsumes issues such as the choice of exchange rate regime, intermediate targets (if any), forecasting mechanisms, which may or may not give precedence to the information content of specific economic variables, and indicators of the thrust of policy or overall conditions in the monetary sphere. Individual country frameworks differ considerably in these respects. However, the financial variables playing a role at the strategic level are generally not under the close control of the authorities and the corresponding policy decisions usually cover horizons longer than one month. Typical examples of relevant variables are money, credit and asset prices.

In contrast, operating procedures relate to what might be called the *tactical* level of policy implementation, the "nuts and bolts" of monetary policy. They cover the choice both of *instruments* and of *operating objectives* or *targets*. These are variables which, being more proximate to the policy instruments in the causal chain, can be influenced quite closely by the central bank. Examples of policy instruments are official interest rates (eg those on standing facilities), market operations (eg repo tenders), reserve requirements and, in the past, direct controls such as ceilings on loans or on bank deposit and loan rates. The basic choice concerning operating objectives has generally been which relative weight to attach to bank reserves and short-term money market rates as a reference for policy. Thus, operating procedures deal with the daily implementation of policy, although the planning horizon may extend as far as one month or even longer in certain cases (see below).

Currently, *all the central banks in industrial countries implement monetary policy through market-oriented instruments geared to influencing closely short-term interest rates as operating objectives*.[4] They do so largely by determining the conditions that equilibrate supply and demand in the market for bank reserves (bank deposits with the central bank). It is in this relatively unglamorous and often obscure corner of the financial markets that the ultimate source of the central banks' power to influence economic activity resides.

The market for bank reserves is a special one indeed. The central bank is a monopolist supplier that can also directly affect demand. It can, and often does, affect it, for instance, by setting reserve requirements or by helping to shape the characteristics of, and by operating, key interbank settlement systems. Moreover, the way in which central banks attain their objectives relies on a varying mixture of stated and unstated rules, conventions and communication strategies which are bewildering to the uninitiated.[5]

Despite the complexity and country-specificity of operating procedures, a stylised framework can throw light on how the main features of policy implementation vary with institutional arrangements.[6] The resulting paradigms provide a useful compass for the more detailed analysis that follows. It is helpful to consider the demand for and supply of bank reserves in turn.

The demand for bank reserves

The characteristics of the demand for bank reserves depend crucially on whether binding reserve requirements are in place.

Working balances

In the *absence of a binding reserve requirement*, the demand for bank reserves is essentially a demand for settlement (working) balances. While banks are legally required to settle on the books of

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[4] The partial exception until 1999 was the Swiss National Bank, whose main focus was the quantity of bank reserves.

[5] In addition, it is not uncommon for interbank markets to be dominated by relatively few players, especially with regard to interbank settlement flows. This can have a considerable influence on the process by which the relevant interest rate, quantities and distribution of reserves are determined in the system. It raises the possibility of strategic interactions between the central bank and market players and between market players themselves. Moreover, it puts a premium on the role of conventions and non-market mechanisms.

[6] This is an adaptation of the framework illustrated in J T Kneeshaw and P Van den Bergh (1989), "Changes in central bank money market operating procedures in the 1980s", *BIS Economic Paper*, no 23, January.

the central bank only in a few cases, such as Canada and Australia, they generally do so for several reasons. Prominent among these are the direct access to the ultimate source of liquidity in the system, the reduction in credit risk resulting from settlement in a risk-free medium and competitive considerations, given that the central bank is a neutral participant, and at times even arbiter, in the market.

Settlement balances clearly have a high cost when, as is generally the case, they bear no interest. In this case, ending the day with a positive working balance means incurring an opportunity cost equivalent to the overnight (day-to-day) rate. The main reason why a bank would willingly aim at holding, on average, such positive balances is precautionary, viz the risk of having to incur a penalty over the market rate owing to the inability to meet its settlement obligations with its existing balance at the central bank. This penalty may take the form of premia on prevailing overnight rates, rationing in the interbank market as limits to credit lines are hit and, finally, penal and possibly uncertain interest rate costs or quantitative restrictions on borrowing from the central bank itself.

As a result, the demand for working balances is largely determined by the institutional and operational characteristics of payments and settlements and by the terms and conditions of central bank late-day assistance. In general, banks would tend to keep their holdings of working balances to a minimum.[7] Indeed, where (as is often the case) the settlement system provides of a period of borrowing/lending among participants *after* the positions become known, the need for any precautionary holdings is much reduced, if not eliminated: banks would then target (approximately) zero balances.

More importantly, and for much the same reasons, the demand for settlement balances is likely to be *very insensitive* to changes in the overnight rate over its typical range of variation (Graph 2, Panels A and B).[8] Reductions in this rate, for example, would hardly in themselves entice banks into willingly increasing their holdings. The demand could also be unstable, especially at the *aggregate* level, if banks failed actively to manage their positions and in the presence of technical or behavioural impediments to a smooth redistribution of reserves in the system (Panel C).

A very interest inelastic, and possibly unstable, demand for working balances calls for *active management of the supply of liquidity* by the central bank on a daily basis if large fluctuations in the overnight rate are to be avoided (Panel C). It also puts a premium on *signalling mechanisms* aimed at guiding the rate over the regions where it may, in effect, be largely indeterminate.

Reserve requirements

Two preconditions must be fulfilled for reserve requirements to be the binding factor in determining the (*marginal*) demand for reserves. First, it should be possible to use the reserve requirement holdings to meet settlement needs. Second, the amount of reserves banks need to hold to comply with the reserve requirement should exceed their working balance targets. Clearly, these conditions cannot be met on those days when the reserve requirement calls for a *specific* amount of reserves to be attained. In this case, the bank cannot rely on that amount to meet its liquidity needs, ie that amount is a bye-gone.[9] As a result, the factor influencing marginal demand is the working balance (*excess holdings*) target (Graph 3, Panel A). The conditions can be met only if some *averaging provision* exists, allowing individual banks to offset deficiencies with surpluses over a given period. In addition, the size of the deficiencies that a bank would wish to run should not be such as to infringe the minimum working balance needs.[10]

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[7] If the central bank allows banks to overdraw their central bank accounts on attractive terms relative to the market, they may even target a "negative" balance, that is, they may target to be overdrawn. This was the case in the Netherlands.

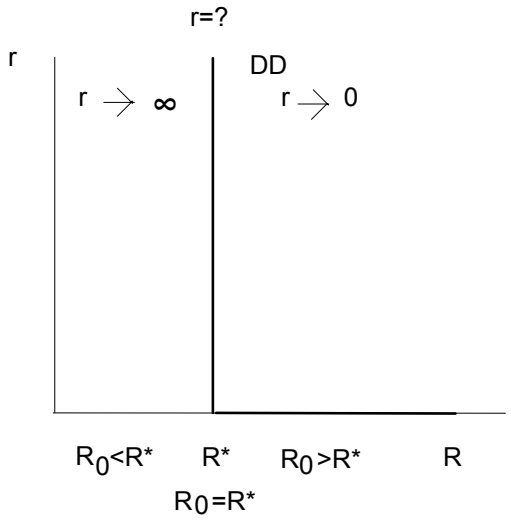
[8] This statement should be read as reflecting typical situations; the specific characteristics will depend on the factors mentioned in the previous paragraph.

[9] This is a simplified analysis, which implicitly assumes that the costs of not meeting the reserve requirement are infinite. When this is not the case and/or carry-over provisions exist, the analysis should be more nuanced.

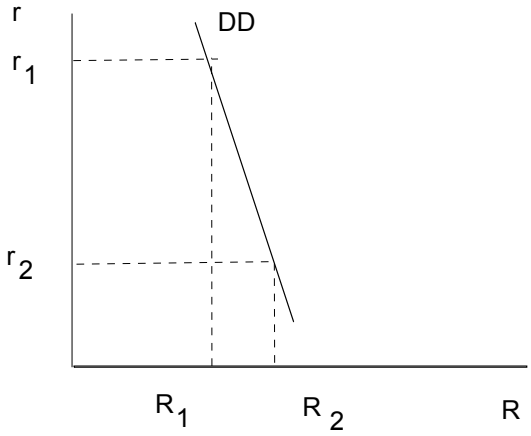
[10] More correctly, for given expectations about the evolution of the overnight rate, it should not be such as to make considerations regarding working balance needs influence desired holdings for that day.

Graph 2
The demand for working balances

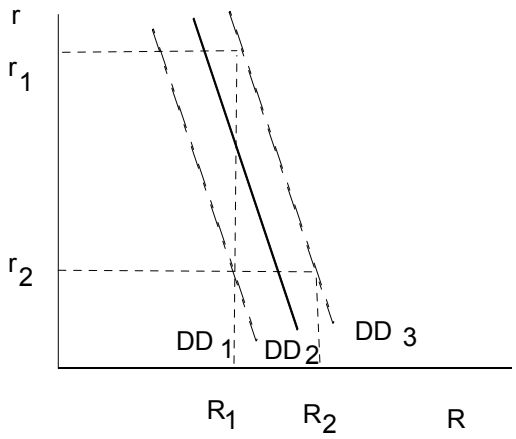
Panel A: No interest rate sensitivity



Panel B: Small interest rate sensitivity



Panel C: Instability



Comments:

Panel A: The interest rate is either indeterminate ($R_0 = R^*$), or tends to zero ($R_0 > R^*$), or tends to infinity ($R_0 < R^*$).

Panel B: Small changes in the supply of bank reserves (R_1 to R_2) result in large changes in the interest rate (r_1 to r_2).

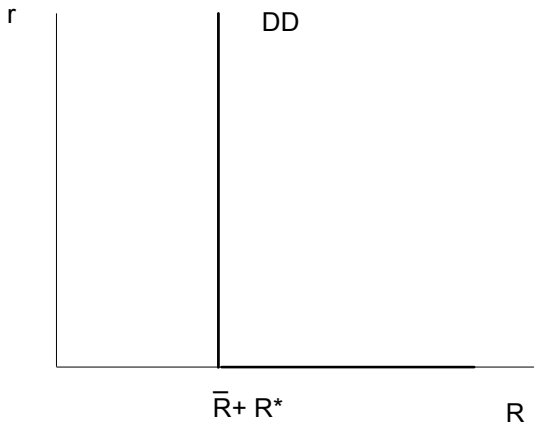
Panel C: Given a low interest rate sensitivity, instability (DD_1 to DD_3) results in large changes in the interest rate (r_2 to r_1) for a given supply of reserves (R_1). Actively providing reserves (R_1 or R_2) can stabilise the interest rate.

Role of signalling: In case A, signalling can help to focus expectations on a particular interest rate within the range of indeterminateness.

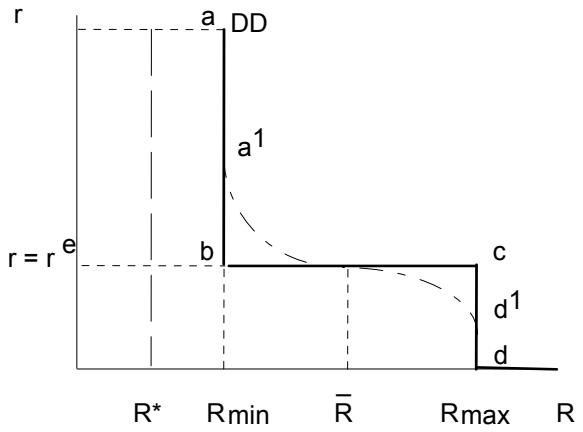
Graph 3

The demand for bank reserves under reserve requirements

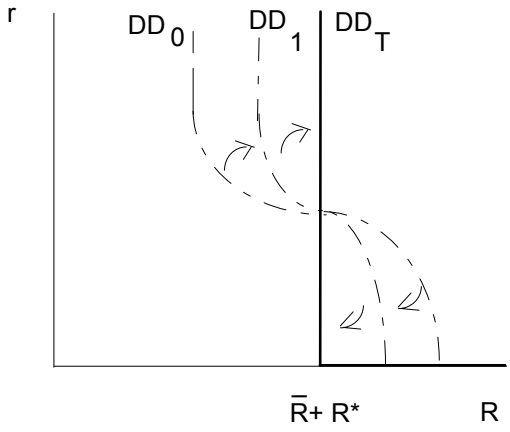
Panel A: End of maintenance period



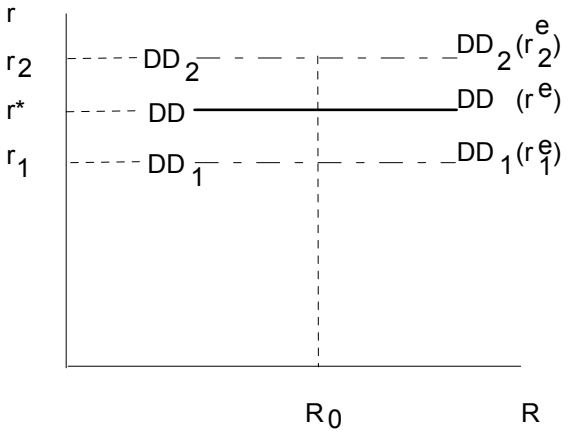
Panel B: Beginning of maintenance period; extreme case



Panel C: Time-varying sensitivity



Panel D: Instability



Panel A: At the end of the maintenance period the demand for bank reserves converges to that for working balances (R^*) plus whatever amount is necessary to meet the average reserve requirement. (This will be equal to the average requirement itself ($\bar{R}$, as assumed in the graph) in the case in which the banks are already on target in the preceding period.)

Panel B: Within a range determined by the level of the requirement and length of the averaging period (R_{min} - R_{max}), as long as the minimum bound exceeds the demand for working balances (R^*) the demand for bank reserves will be very elastic (a^1, d^1), and in the extreme perfectly (b, c) elastic, at the level of the overnight rate expected to prevail during the period (r^e).

Panel C: Over time, the demand for reserves converges to that ruling at the end of the maintenance period (DD_0 to DD_T).

Panel D: Changes in the interest rate expected to prevail (r^e_1 to r^e_2) result in similar changes in the market rate (r_1 to r_2) for any given supply of reserves (R_0).

Role of signalling: By focusing expectations around a specific value of the interest rate, signalling can shift the (interest-sensitive) demand for bank reserves to equilibrate the market at a rate consistent with central bank policy (eg r^* in Panel D).

When reserve requirements are the binding factor, averaging provisions can act as a buffer for the overnight rate. At any given point in time in the averaging ("maintenance") period, banks would tend to be indifferent about the amount of reserves they held as long as: (a) the opportunity cost of holding them was expected to change little over the remainder of the period; (b) they held those expectations with little uncertainty or were not much concerned about it (low "risk aversion"). Thus, with fixed or zero-remunerated reserve requirements, they would be indifferent if they were confident that no significant increases/decreases in the overnight rate would take place.[11] Under these conditions, the demand for reserves would be *very elastic* around the level of the rate expected to prevail in the future (Panel B).[12] The high sensitivity of demand to the interest rate would help to cushion the impact of changes in the supply of reserves on the overnight rate (same graph).

The extent to which reserve requirements can act as a buffer declines during the maintenance period. As time passes, the room for manoeuvre is increasingly constrained by the cumulated reserve position, since the number of days available for offsetting any excess/deficiency falls and the size of the corresponding adjustment rises. Similarly, banks would be less willing to arbitrage, as the risks of being unable to offset positions at prevailing market rates would rise. This suggests that the interest elasticity of the demand for reserves would tend to decline, especially towards the end of the maintenance period, converging on the last day to that of working balances (Panel C).[13],[14]

These arguments suggest that, ceteris paribus, reserve requirements with averaging provisions call for *less active* day-to-day management of liquidity by the central bank. The extent to which this is true will depend on their level, on the length of the averaging period and on banks' willingness to arbitrage expected changes in the overnight rate over time. At the same time, averaging introduces a new potential source of instability in the demand for reserves, viz volatile *expectations* about the path of the overnight rate during the maintenance period (Panel D).[15] If anything, this makes signalling even more important as a mechanism for limiting volatility in that rate.

The supply of bank reserves

Given the characteristics of the demand for bank reserves, the central bank's task is to regulate the supply in order to achieve its interest rate or quantitative objectives. There are essentially two aspects to this task. The first is how to go about adjusting the liquidity position of the system, balancing supply with demand ("*liquidity management*" proper). The second is how to reinforce any influence that liquidity adjustments may have on interest rates through specific communication strategies vis-à-vis market participants (essentially "*signalling mechanisms*").

Liquidity management involves offsetting to the extent necessary the autonomous (net) sources of reserves ("*liquidity*")[16] which imply changes in the other items of the central bank's balance sheet. While varying somewhat from country to country, these sources include: primarily, increases in net foreign assets resulting, for example, from foreign exchange intervention; increases in (net) lending to the government; changes in other residual net assets, such as float or capital and reserves (other than

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[11] If the remuneration was fixed as a roughly constant margin around the *prevailing* overnight rate, banks would tend to be indifferent regardless of the expected path of the overnight rate.

[12] Under the extreme assumptions of risk neutrality and uniform expectations, the demand would be infinitely elastic at the expected rate.

[13] On the last day, the amount demanded would be equal to whatever amount was necessary to meet the reserve requirement plus any excess holdings for settlement purposes. In fact, the speed of convergence would depend on the actual liquidity shocks hitting the system. For instance, in the extreme case in which on the first day of the maintenance period the supply of liquidity was so large as to imply reserve holdings of a size equivalent to working balances for the rest of the period to meet the requirement, any flexibility would immediately be lost.

[14] Given this convergence, assuming that the demand for working balances is effectively insensitive to interest rates, the rate on the last day would again be largely indeterminate. This implies a considerable potential for instability in the absence of clear signalling. Given intertemporal arbitrage, once the expected interest rate for the end of the period is determined, the equilibrium expected interest rates for the rest of the period can be derived.

[15] Strictly speaking, this would also occur in the presence of a demand curve for working balances which was completely insensitive to the current overnight rate. If the central bank cared only about longer rates, the overnight rate would be free to adjust through arbitrage to expectations that would only be anchored at those longer maturities.

[16] Henceforth the terms "bank reserves" and "liquidity" will be used interchangeably.

those arising from valuation effects; see Box 1); and reductions in currency in circulation ("cash").[17] An *autonomous* surplus (deficit) can be said to exist if autonomous factors lead to a net increase in (withdrawal of) liquidity.[18]

Box 1

Stylised sources and uses of bank reserves

Consider an extremely stylised balance sheet of the central bank, with Δ denoting the change in the relevant variable.

Balance sheet of the central bank

Assets	Liabilities
Δ Net foreign assets	Δ Cash (notes)
Δ Net lending to the government	Δ Bank reserves
Δ Net lending to banks	
Δ Other net assets	

The item "Other net assets" would typically include changes in capital and reserves (negative sign), float and changes in the valuation of assets. Assume that all the channels for influencing liquidity under the control of the monetary authorities over the relevant horizon have been grouped under Δ Net lending to banks (or the *net policy position*). If so, the other items on the asset side are purely "autonomous". Then, rearranging terms:

Autonomous liquidity position (+, injection/–, withdrawal) =

Δ Net foreign assets + Δ Net lending to the government
+ Δ Other net assets – Δ Cash

and:

D Bank reserves = Autonomous liquidity position + Net policy position

From the viewpoint of liquidity management, it is generally useful to think in ex ante terms. Replacing "Δ Bank reserves" by the quantity demanded (implicitly at some desired rate) and rearranging terms we have:

Net liquidity position = Autonomous liquidity position – Δ^{d} Bank reserves

The net liquidity position is the mirror image of the amount of reserves that the central bank should provide through its operations to balance the market (at the desired interest rate). In turn, bank reserves can be split into two items: reserve requirements (if any) and (net) excess reserves or working balances, depending on circumstances.

[17] Conceptually, one may also wish to add to the list those standing facilities at *below* market rates activated on demand by banks.

[18] Sometimes the term "structural" surplus/deficit is alternatively used. However, it would seem preferable to restrict such a term to situations where the surplus/deficit from autonomous factors is highly persistent over time.

On an ex post basis, the sum of the net liquidity created through the autonomous channels and through central bank operations represents the net addition to bank reserves. On an ex ante basis, it is often useful to think of the difference between the autonomous creation of reserves and the amount demanded as the balance that has to be met by central bank operations (the "net liquidity position"). An integral part of liquidity management is precisely the *forecast* of the net liquidity position, which provides an ex ante basis for the assessment of the need to effect operations. If supply falls short of demand, a "net liquidity deficit" (shortage) is generally said to exist, in which case the central bank needs to inject liquidity; in the event of a "net liquidity surplus", it needs to withdraw liquidity.

Central banks thus expend a lot of effort in forecasting the path of autonomous factors. Where reserve requirements with averaging provisions are in place, as in the three monetary areas under consideration, particular, but not exclusive, attention is paid to the impact of autonomous factors during the maintenance period ahead. Together with the required reserves target plus the estimate of any excess reserves, this information provides the basis for the benchmark amount of liquidity that needs to be added, or withdrawn, during the period.

In principle, central banks can meet net liquidity surpluses and shortages equally. Several central banks, however, prefer to operate with *net deficits*, as net creditors rather than debtors in the market. Quite apart from their possible influence on the marginal demand for reserves, reserve requirements can be aimed at raising average demand, thereby possibly turning an autonomous surplus into a net liquidity deficit. In addition, in a number of systems the operation(s) setting the tone of policy (signalling operations) can only inject liquidity ("asymmetric" systems). In this case, in order to ensure that the operation remains active, the central bank needs to drain any excess liquidity from the system. When reserve requirements are not in place or insufficient for the purpose, the central bank could then be withdrawing liquidity through some (market) transactions while injecting it through others, possibly even on the same day.

Liquidity can be adjusted either through transactions entered into at the *discretion* of the central bank or through *standing facilities*, which are activated on demand by market participants (Box 2).[19] Either of these may be the effective marginal source of liquidity equilibrating the market. But by and large, and increasingly so, central banks have preferred to use discretionary operations to make the required adjustments in marginal liquidity. This is indeed the case in the three currency areas under consideration. Correspondingly, they have tended to use standing facilities primarily as "safety valves" for end-of-day imbalances, as guideposts setting limits to the range of fluctuation of the overnight rate, or, in some cases, as sources of subsidised inframarginal liquidity (Graph 4, Panels A and B).

Discretionary operations typically take the form of either firm purchases/sales of securities or, more often, reversed transactions in domestic or foreign currency (Box 2). Especially in countries with reserve requirements and averaging provisions, a distinction is often made between regular and "irregular" transactions. Regular transactions typically aim at covering the bulk of liquidity needs; their timing and, sometimes, maturity are closely tied to the characteristics of the maintenance period.[20] By contrast, irregular transactions are employed to make the necessary adjustments to the volume of liquidity as dictated by evolving circumstances.

Partly owing to the limited use of standing facilities and the characteristics of the demand for bank reserves, central banks rely on *signalling mechanisms* to guide market views of very short-term rates and hence to strengthen their influence over them. These mechanisms may involve adjustments in quantities, but have increasingly taken the form of explicit references to specific interest rate levels. Such signals are sent through announcements of interest rate targets or bands, through the interest rates at which market, typically regular, operations are executed and/or through the rate posted on standing facilities.

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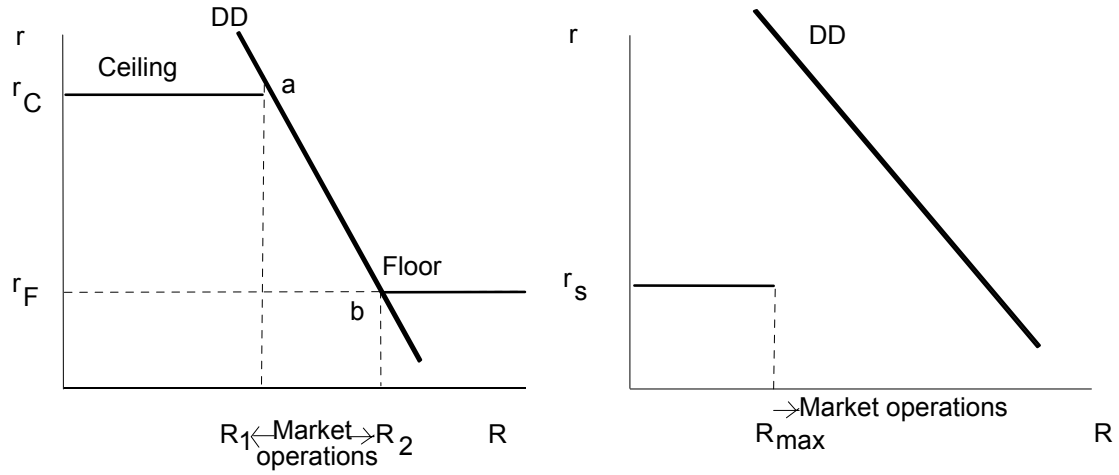
[19] The distinction between the two need not map one-to-one into the type of instrument used. Reverse transactions such as repos, a typically discretionary instrument, may be offered on a standing basis, or discretion may be used in granting credit through a discount window. Similarly, a standing facility may at times be suspended and the volume of finance or other terms be subject to the discretion of the central bank.

[20] Not all regular operations are used for this purpose.

Graph 4
The supply of bank reserves

Panel A: Bounds-setting standing facilities **Panel B: Below-market (subsidised) facilities**



Panel A: The standing facility at r_C sets a ceiling for the interest rate; the one at r_F sets a floor. (Given the presence of the facilities, the demand curve will itself tend to be infinitely elastic at the corresponding rates r_C, r_F.) Market operations can be used to affect the supply between R_1 and R_2. The points R_1 and R_2 shift with the demand curve.

Panel B: A below market facility rations credit to the point R_{max}. As long as the demand for reserves exceeds supply at that rate, r_S does not determine market rates; it merely provides inframarginal, comparatively cheap liquidity.

The policy rate and the operating target

The interest rate which is under the direct control of the central bank and which provides the main policy signal is usually referred to as the *policy rate*. This could be, for instance, the rate on the (regular) market operation that sends the main signal (eg a tender rate) or the announcement of a target for a particular market rate. The market rate, not directly set by the central bank, that is the main focus of policy is known as the *operating target or objective*.[21] When the policy rate is the announcement of a specific target for a market rate, that market rate is also the operating target.

Much of the previous discussion was conducted in terms of the behaviour of the overnight rate itself: this is the money market interest rate which is largely determined in the market for bank reserves and over which the central bank has the closest control. Yet the overnight rate need not be the operating target. The authorities may focus on interest rates of a somewhat longer maturity, say one month. In either case, the previous analysis still holds. The main implication is that, ceteris paribus, greater volatility in the overnight rate would be accepted. In particular, if the central bank focused on somewhat longer rates, it would tend to tolerate unexpected movements in the overnight rate provided they did not undermine the attainment of the operating objective.

[21] In principle, the operating target could also be a quantity, rather than price, variable, eg the volume of reserve balances. As already mentioned, however, all industrial country central banks at present rely on interest rates as operating targets.

Box 2

A taxonomy of central bank operations

The central bank's mechanisms, other than reserve requirements, for adjusting the liquidity (bank reserves) in the market (ie making up "net lending to banks" or the "net policy position") can be broken down according to several criteria: by the technical form of the instrument, by the degree of discretion exercised by the central bank in its use and by the frequency of its employment.

A possible breakdown *by instrument*, used in what follows, is:

1. *Central bank lending*: loans and advances, almost exclusively against collateral, not granted through tenders. Defined here to also include the corresponding discounting of securities.
2. *Reverse transactions against domestic currency assets*: purchases (sales) of assets reversed at some point in the future; equivalent in cash flow terms to collateralised lending (borrowing). From the viewpoint of the central bank, temporary purchases ("repos") inject liquidity, temporary sales ("reverse repos") withdraw it.
3. *Reverse transactions against foreign currency assets*: equivalent to the above but against assets denominated in foreign currency. Foreign exchange swaps are the most common. They can be used either to inject liquidity (temporary purchases of foreign currency) or to withdraw it (temporary sales of foreign currency).
4. *Outright transactions in the secondary market*: firm purchases/sales of outstanding securities.
5. *Issues of short-term paper*: sales of central bank paper in the primary market. Defined to also include issues by the central bank of government paper on its behalf performing a similar function.
6. *Operations in the interbank market*: intervention in the interbank cash market via the collection of deposits and (possibly unsecured) lending.
7. *Transfers of government deposits*: a transfer from the central bank's books to those of banks injects liquidity; a transfer in the opposite direction reduces it.

Operations 2 to 6 are referred to as "market" operations.[1]

In terms of the *degree of discretion*, a common distinction is between:

1. *Standing facilities*: operations activated on demand by market participants (mainly banks).
2. *Discretionary operations*: carried out at the discretion of the central bank.

In terms of *frequency*, transactions can be divided into:

1. *Regular*: occurring at a regular frequency, known in advance.
2. *Irregular*: the opposite case.

Typically, the distinction between regular and irregular operations is applied to market transactions only. Irregular operations (other than in the form of central bank lending) are sometimes known as *fine-tuning*. Contrary to the common usage of the term, however, not all irregular (fine-tuning) operations are designed to modulate precisely the supply of reserves on a day-to-day basis with a view to balancing the market.

[1] Sometimes the term "open market" is used even if, strictly speaking, the central bank may restrict the range of counterparties and/or not transact in the established private market.

II. Assessing the operating frameworks[22]

Armed with this general framework and the corresponding taxonomy, it is now easier to assess the main similarities and differences between the sets of operating procedures in the three main world currency areas. This section considers sequentially the following aspects: the relationship between policy rates and operating targets within the broader spectrum of available signalling mechanisms; the role of standing facilities; the volatility and forecastability of autonomous factors; the characteristics of the demand for reserve balances; and a number of features of market operations.[23]

The policy rate, the operating target and signalling mechanisms

As regards the choice of policy rate, operating target and signalling mechanisms, the three currency zones fall into two camps. In Japan and the United States, the policy rate is the announced target level for the overnight rate, which is therefore also the market rate acting as operating target (more precisely, the federal funds rate[24] and the uncollateralised call money rate, respectively). In contrast, in the Eurosystem the policy rate is the (fixed tender) rate on the regular (weekly) main refinancing operations (repos) and the central bank officially has no *specific* market rate functioning as operating target, though the General Council can give indications about the desired level of short-term rates.

The choice of arrangements reflects in no small measure the historical heritage. In both the United States and Japan, procedures have always focused on the overnight market while no *price* signals have ever been provided through the rates on central bank operations. In this sense, the corresponding central banks have always acted as price takers in their market operations. The Eurosystem procedures reflect the typical arrangements that prevailed in the countries making up the euro area. Central banks there had at least one type of regular operation, generally repo auctions, through which they conveyed the key policy signal, with other transactions normally being carried out at market prices. In contrast to the Eurosystem, however, arrangements were sometimes accompanied by clearer operating targets for the overnight or one-month rates.

The choice of procedures has implications for the degree to which deviations of the overnight rate from the policy rate can be tolerated. If a target level for the overnight rate is announced, while short-run deviations may be of little consequence, persistent deviations in one direction or another would tend to be seen as inconsistent with the announced policy intentions. If the central bank tender rate is the policy rate, the freedom to allow deviations of the overnight or other short-term rates from the one providing the key policy signal is greater.

At the same time, the differences between the two approaches should not be overstated. The gain in flexibility would be particularly valuable in circumstances that required large movements in the overnight rate without altering the signal concerning the basic stance of policy. This would generally tend to occur either in unusual market circumstances or, more typically, if the central bank wished to resist a currency attack. This latter case, however, does not apply to the Eurosystem. In more normal conditions, one would expect the policy and overnight rates to be very close. This has indeed been the structure in the euro area setup.[25] In fact, while the Eurosystem does not have an official operating target, the framework seems to be conceived with a particular eye towards the overnight rate, as most clearly illustrated by the coincident maturity of the standing facilities.

Moreover, the three frameworks are identical in one important aspect, the great clarity and specificity with which the policy signal is provided. This is common to all current operating frameworks in industrial countries. It is the result of a longer-term evolution away from opaqueness towards

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[22] A postscript updates the information on the frameworks to the autumn of 2001.

[23] For an application of the conceptual framework to the analysis of operating procedures in a sample of Asian countries, see Borio C E V and R N McCauley (2001): "Comparing monetary policy operating procedures in Indonesia, Korea, Malaysia and Thailand", in G de Brouwer and P Drysdale (eds), Financial markets and policies in East Asia, Routledge, London, pp 253-85.

[24] This is the rate on unsecured overnight interbank lending (call rate).

[25] Some complications may arise as a result of the different maturity of the operations and other peculiarities of the arrangements when changes in the policy rate are expected in the maintenance period (see below).

transparency, an evolution that has also affected other aspects of policy. In fact, in both Japan and the United States until the mid-1990s, the policy signals consisted of a mixture of low-key quantity signals through market operations and higher-profile price signals through the discount rate.[26] Inertia in market interpretations meant that, after these practices were discontinued, it was not unusual for market participants mistakenly to read in purely liquidity management operations a policy content from time to time. It was partly in order to avoid such confusion that in March 2000 the Bank of Japan stopped announcing the "excess liquidity" prevailing at different points in the maintenance period, a concept which had been used as a low-key policy signal to steer the overnight rate until 1995.

The main difference between the framework adopted by the Eurosystem and the Fed or the Bank of Japan is that the Eurosystem has explicitly stated that, if the circumstances required this, it could move from fixed rate to variable rate tenders.[27] In this case, the main signal would probably come from changes in the rates charged on standing facilities, as variable rate tenders are used to allow market forces to play a greater role in determining the corresponding rate. In this respect, the Eurosystem is again following in the footsteps of some of its predecessors. In particular, the Bundesbank would switch from variable to fixed rate tenders depending on circumstances. While having a preference for variable rate tenders, seen as more consistent with a hands-off, market-oriented policy, the Bundesbank would sometimes resort to fixed rate auctions to give clearer signals or calibrate the pace of decline in market rates.

Standing facilities

The main dividing line in terms of standing facility arrangements is again between the Eurosystem, on the one hand, and the Fed and Bank of Japan, on the other. In the Eurosystem, two standing facilities available on demand (a marginal lending and a deposit facility) form a corridor that sets a maximum and minimum for the overnight rate, given that the maturity of the operations is overnight. In the United States and Japan, there are no facilities available on demand, and none exists to deposit funds with the central bank at positive rates.[28] In the United States, following the deactivation of the temporary special lending facilities introduced to cope with the Year 2000 changeover, the only facility in place is the discount window, which provides funding at below market (subsidised) rates and on a discretionary basis at various maturities. In Japan, the lending facility is at above market rates, as in the Eurosystem.

In all three systems, the main function of the standing facilities nowadays is to act as a safety valve for end-of-day liquidity pressures, not so much for the banking system as a whole (global liquidity position) but for individual institutions. This reflects a preference for steering the overnight rate through discretionary market operations, rather than relying on the facilities themselves, a trend that has been obvious since the 1970s. The large width of the corridor set in the Eurosystem is a clear illustration: the overnight rate remains well within the bounds. Likewise, these facilities have now largely lost their signalling function, given the greater use of explicit announcements of target rates or the higher prominence of signals sent through auctions of liquidity.[29]

The main difference between the systems is one of degree rather than kind, viz the degree to which individual market participants can assume that the central bank will automatically accommodate unexpected liquidity imbalances in their end-of-day treasury position, be these undesired surpluses or shortfalls. The discretionary nature of the end-of-day facilities of the Federal Reserve[30] and Bank of

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[26] See Borio *ibid* for a more detailed discussion and for examples derived from other central banks.

[27] The arrangements have been designed to allow it to operate through either fixed or variable rate tenders.

[28] The zero interest rate policy currently pursued in Japan would make such a deposit facility largely redundant, of course. But the absence of this instrument reflects a longer-term decision rather than specific circumstances.

[29] For instance, in order to provide a signal that it wished to see rates nudging higher, the Bundesbank could induce banks to borrow from the lombard facility for some time. German banks could monitor the system's recourse to the facility with a one-day lag.

[30] Of course, since the Fed's discount rate is at below market prices, credit *needs* to be rationed somehow. However, the tougher attitude towards accommodation of end-of-day individual imbalances is also reflected in the size of the penalty rate on end-of-day overdrafts, which is incurred unless banks cover them through the discount window facility. The penalty is as high as 4 percentage points in addition to the (effective) federal funds rate. Moreover, the balances count as a deficiency in the calculation of the fulfilment of reserve requirements.

Japan and the tighter set of restrictions attached to the corresponding extension of credit might be construed as indicative of a somewhat greater reluctance to substitute themselves for the market in resolving undesired individual liquidity positions. It is consistent with the view that, *once the central bank makes sure that in the aggregate the amount of liquidity is correct*, these undesired positions stem from individual mistakes and from insufficient attention to liquidity management by participants. Accordingly, this central bank attitude can help to promote a sense of self-discipline and places greater demands on interbank transactions. The other side of the coin is that the central bank has to make sure that it honours its own part of the deal, namely that the aggregate amount of liquidity is indeed the "right one". Ceteris paribus, this would tend to place a premium on accurate forecasts of liquidity supply and demand as well as imply a heavier reliance on frequent discretionary market liquidity operations to make the necessary adjustments. The choice of carrying out operations at market prices rather than setting the desired rate, while simply announcing targets for the overnight rate, is part and parcel of the same basic philosophy.

Even so, in part the lack of use of the facilities reflects another factor, namely the connotations of emergency financing attached to them. In the United States, until the early 1990s access to the discount facility for "adjustment credit" was a routine matter and a well behaved relationship existed between demand for such funding and the spread between the overnight rate and the discount rate. Accordingly, the spread was a key element in policy implementation, allowing the Fed to gauge the need for market operations to steer the overnight rate. The situation changed in the early 1990s, when a series of episodes of financial distress among banks entrenched the view that discount window borrowing was a sign of weakness. Since then, despite the return to strength of the banking system, this perception has persisted and has resulted in great reluctance to turn to the window, regardless of the market cost of funds. This has complicated reserve management by the Fed and hindered the role of the window as a possible effective safety valve. Similarly, emergency liquidity connotations also attach to the Bank of Japan's current regular collateralised above market facility, itself the successor of an actively used below market discount window.[31] Credit under the facility, which the central bank has not relied upon as a monetary policy management tool since January 1996, is granted at above market rates and only if the institution cannot find other reasonable sources of funds.[32] In both countries, abandoning the emergency connotations would most likely require an overhaul in the arrangements. By contrast, in the Eurosystem the distinction between emergency liquidity assistance and normal credits is more clear-cut: emergency assistance begins once a bank exhausts the standard collateral available to draw credit under the marginal lending facility.

The volatility and forecastability of autonomous factors

Other things being equal, a higher volatility of autonomous factors would tend to increase the frequency and volume of discretionary operations necessary to match the anticipated cash flows to the desired extent. Likewise, the more unpredictable the autonomous cashflows, the greater is the need for operations to offset unexpected movements. The available statistics indicate that, measured in the same currency unit, the daily volatility of autonomous factors is highest by far in Japan, with those in the United States and the Eurosystem being of a similar order of magnitude. If measured in relation to the size of the reserve requirement, however, volatility in the United States[33] is closer to that prevailing in Japan, and considerably above that in the Eurosystem (Table 1). In the three currency zones, forecasting efforts reduce substantially the unpredictability of change in autonomous factors, at least at short horizons. The reduction is comparatively sizeable in Japan. Measured in relation to the reserve requirement, forecast errors tend to be largest in the United States and lowest in the Eurosystem.

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[31] The central bank used this facility as an active tool of liquidity management until mid-1995, deciding amounts and maturities at its own discretion as well as being able to recall the credit extended at will. This changed in July 1995, when the overnight rate was steered below the discount rate for the first time.

[32] Reinforcing the emergency liquidity connotations, since 1998 the facility has been activated by the Bank Examination and Surveillance Department. If, however, the loans were exceptionally used in monetary operations, the Financial Markets Department would be responsible for granting the credit.

[33] In addition, because of the shorter length of the averaging period - about half those elsewhere (see below) - the volatility normalised by the daily average reserve requirements is even higher in the United States.

Table 1

Daily volatility and forecastability of autonomous factors in 1999

	Volatility			Forecast error		Memo:
	Average absolute change	Maximum absolute change	Standard deviation	Average	Maximum	Required reserve balances
	In % of required reserve balance					USD billions
Eurosystem						
Banknotes	0.76	3.63	0.96	0.27	1.67	
Treasury funds	3.47	24.39	5.45	0.56	7.89	
Float	0.69	4.91	0.99	0.60	4.35	
Net balance	3.72	24.57	5.80	0.91	8.22	108.3
Bank of Japan						
Banknotes	8.97	42.96	11.83	0.86	4.78	
Treasury funds	23.78	232.15	41.58	1.66	12.48	
Net balance	24.67	217.18	40.96	1.92	13.77	33.8
Federal Reserve						
Banknotes	6.62	39.75	8.26	1.73	10.06	
Treasury funds	6.55	55.02	10.66	4.49	24.27	
Float	5.12	45.94		2.90	31.58	
Net balance	14.38	130.27	18.68	6.49	36.98	13.5

Source: National central banks.

Turning to individual autonomous factors, there are considerable similarities across countries. In all three systems, currency is among the most volatile items, but is also one with rather predictable seasonal patterns.[34] With the exception of float, which is particularly volatile and difficult to forecast at high frequencies in the United States and in the Eurosystem but not in Japan, the most volatile and unpredictable item relates to the activities of the Treasury. In the Eurosystem, where the arrangements concerning the terms and conditions of holdings of government deposits with the central bank differ across countries, this results primarily from the situation in some national jurisdictions.

Central banks can use a number of expedients to reduce the volatility and forecasting errors associated with the treasury balances. These include, for instance, target balance arrangements (United States), active exchange of information and even penalties for failure to provide accurate forecasts (Belgium) and automatic redepositing of end-of-day balances with banks (Germany)[35]. A more radical measure is not to supply deposit accounts to the government (eg Sweden and Austria). This step, however, would call for a broader set of considerations, some of which are unrelated to liquidity management for monetary policy purposes. Moreover, it would not necessarily make Treasury activities irrelevant. In general, an active and independent management by the government of its surplus funds in the market could potentially interfere with monetary policy implementation by virtue of the sheer size of the positions, potentially confounding policy signals. In order to limit this risk, for

[34] In the euro area, at present the forecast of the demand for currency is still based on the aggregation of national forecasts. In future, a separate area-wide forecast could be implemented.

[35] In Germany, a sweep procedure automatically channels end-of-day government balances to several banks so as to ensure that the net balance with the central bank is zero.

instance, the Swiss National Bank has an agreement that does not permit the Treasury to invest its surplus funds in the overnight market.

The demand for reserve balances

In all three currency areas, the marginal demand for bank reserves is predominantly determined by the reserve requirement, thanks to the averaging provisions. However, seen as a cushion to absorb autonomous fluctuations, the requirements are comparatively less effective in the United States.[36] Several factors contribute to this result. First, the overall level is lower. Second, the requirements can be fulfilled through vault cash rather than through deposits with the central bank. Several large banks are now in a position to meet the requirements exclusively with vault cash ("non-bound" institutions), and it is not uncommon for small ones to be able to do so. In 1999, for instance, three quarters of the reserve requirement was fulfilled with cash. Finally, the averaging period is shorter, two weeks rather than one month, although carry-over provisions and lower penalties for non-compliance tend to work in the opposite direction. These characteristics put a premium on the accuracy of liquidity forecasts and on discretionary market operations as a means of smoothing out fluctuations. In addition, until the move to lagged accounting at the end of 1998, the fact that the requirements were almost contemporaneous rather than semi-lagged (Japan) or lagged (the Eurosystem) added to the uncertainty in the forecast of the average reserve requirement.

Experience in the United States underscores the impact of these characteristics. In recent years, growing attempts by banks to economise on reserves through active liability management have given rise to concerns by the Fed that volatility in the overnight rate might increase again to levels comparable to those prevailing between late 1990 and 1991, when the demand for working balances had appeared to run ahead of the reserve requirements following the decision to lower them. The main reason has been the growth in "sweep" arrangements, particularly rapid between around 1994 and 1997, whereby banks have been shifting retail deposits at the end of the day from chequing or demand deposit accounts to non-reservable money market accounts. While the process has now slowed somewhat, the rapid decline was associated with an incipient rise in volatility and greater reluctance by banks to arbitrage over the maintenance period.[37] In response, the Fed increased the frequency of operations. Together with improvements in the efficiency of reserve management by financial institutions, this step has prevented a sustained increase in volatility. Admittedly, the periodic announcements of the federal funds target should limit the concern that the volatility in the overnight rate could cloud policy intentions. Nevertheless, higher volatility could potentially impair the smooth functioning of financial markets more generally.

In no small measure, the reserve requirements in the United States retain features consistent with a more quantity-oriented approach to monetary policy implementation, in which the reserve requirements are used as a means of controlling monetary aggregates, as was the case at the time of non-borrowed reserves targeting (October 1979-October 1982). Hence the comparatively short maintenance period, a definition of eligible liabilities which closely matches the previously targeted monetary aggregate (M1) and, until recently, almost contemporaneous reserve accounting.[38,39]

Probably the change in the characteristics of the requirements that would most improve their effectiveness as a buffer would be to increase their level. This, however, would run against the longer-term international policy trend, which has been to reduce the requirements in response to domestic

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[36] Over and above the reserve requirement, banks also pre-commit to hold on average over the maintenance period an amount of clearing balances ("required clearing balances"). The incentive to do so takes the form of rebates on certain central bank services.

[37] In particular, they seem less willing to accumulate excess reserves early in the two-week maintenance period, presumably because of the greater risk of incurring overnight overdrafts later in the period when attempting to work the excess reserves off.

[38] A country where reserve requirements exhibited similar features and which had also used them in a more quantity-oriented framework of monetary control was Spain.

[39] Somewhat ironically, however, the shift from semi-lagged to contemporaneous reserve accounting in the United States took place in 1984, well after the move to borrowed reserves targeting had greatly reduced the significance of the change by placing a sharper focus on short-term rates.

and international competitive pressures so as to limit the corresponding implicit tax. Allowing cash as a reservable asset, while possibly reflecting security risks and transportation costs, is also consistent with these basic considerations.[40] Another possibility, adopted by some central banks, including the Eurosystem, is to remunerate the reserve requirement, thereby reducing or eliminating its opportunity cost while retaining its buffer role. Legislation in the United States, however, prohibits the Fed from paying interest on reserves.

At the same time, the performance of the reserve requirements as a buffer is partly affected by the precise formula used for their remuneration. The ideal formula would ensure that the opportunity cost of holding required reserves was constant during the maintenance period, *irrespective of expectations of reserve holders regarding possible changes in policy rates during the period*. This would minimise the incentive to front- or back-load the demand for reserves in an effort to reduce the cost of holding them, for instance by holding reserves early in the maintenance period if the opportunity cost is expected to rise following an anticipated policy tightening later in the period.

From this perspective, it is unclear whether the remuneration formula adopted by the Eurosystem is fully consistent with the objective of maximising the effectiveness of the reserve requirements in smoothing out fluctuations, even though the requirements have been quite adequate in absorbing the autonomous variability in liquidity. The reason is straightforward. Whenever institutions anticipate a change in policy, the remuneration formula allows them to make a profit at the expense of the central bank, *regardless of the level of the overnight rate*, as long as those expectations are correct and they can finance their positions through the central bank auctions. This is because the remuneration of the reserve requirement is equal to the *average* main refinancing rate (the policy rate) during the reserve period. Accordingly, if credit institutions expected, say, the policy rate to rise during the period, they would borrow from the central bank early in the period and could make an expected profit simply by holding those funds as required reserves.[41] This incentive would not be there if, say, the reserves were remunerated at the main refinancing rate prevailing when held. If so, as long as the overnight rate was kept in line with the main refinancing rate at all times, there would be little incentive to front- or back-load reserve holdings during the maintenance period. Admittedly, the overbidding phenomenon observed in the Eurosystem arrangements is an inherent feature of fixed rate tenders. However, it cannot be excluded that, in periods of firmly held expectations of policy tightening, it might have been exacerbated by the formula for remunerating required reserves.

Market operations

As mentioned, market operations are quantitatively by far the most important instrument for liquidity management, as part of a more generalised trend away from a reliance on standing facilities towards mechanisms perceived to be more consistent with a market-oriented approach. While certain common characteristics can be observed across currency areas, differences also persist, reflecting the basic setup of the liquidity management framework and specific historical and institutional factors. What follows considers only a number of aspects: the attitude towards, and implications of, the structural liquidity position; the frequency of operations; the spectrum of instruments employed; collateral; and the range of counterparties.

The three currency zones typically operate with a *structural liquidity deficit*, implying that the discretionary operations, on balance, need to inject liquidity in the system. While in principle the three systems are designed to cope equally with deficits and surpluses, the framework in the Eurosystem as is currently operated is probably better suited for deficits. This is because the central bank relies on fixed tenders to send the key signal, whereas the other two central banks simply operate at market prices. Under these conditions, there may be greater reluctance to switch to liquidity absorbing transactions in the main refinancing operation so as to minimise changes to what has become a

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[40] In Japan, the very low level of interest rates in recent years, culminating with the adoption of the zero interest rate policy in February 1999, has alleviated pressures to cut the level of (non-remunerated) reserve requirements. It has done so by reducing their opportunity cost to almost zero.

[41] This would also mean that the banks would satisfy their fulfilment targets for the requirements and be induced to lend surplus funds in the overnight market only if the overnight rate was above the prevailing tender rate. This would in turn depend on the degree of accommodation by the Eurosystem.

familiar set of arrangements - indeed, one that had already prevailed in the member countries. In order to maintain continuity, the Eurosystem has at its disposal instruments to generate a structural deficit, eg through the issuance of debt certificates. In fact, the Eurosystem's preference for operating with a structural deficit seems to run deeper, and to reflect the common view among central banks that it is preferable to be on the creditor side of operations, adding rather than withdrawing excess liquidity *at the margin* (see previous section). The level of reserve requirements in the Eurosystem was set partly with this objective in mind. In the United States, the Fed also prefers to inject liquidity in its daily repurchase operations, which it can ensure by adjusting the maturity of repurchase operations and through outright transactions. This preference might in part reflect the fact that its counterparties are natural borrowers through the repo market in their daily business.

The *frequency* of market operations is highest in Japan (more than one per day) and lowest in the Eurosystem (one per week plus an additional one per month, on average), with the United States falling somewhere in between, but being closer to Japan (typically, one per day). These differences largely mirror the effectiveness of averaging provisions dealing with the volatility of autonomous factors, the central bank's forecasting accuracy and a more active use of standing facilities as end-of-day safety valves. Thus, while the Eurosystem can use fine-tuning operations to make marginal adjustments to liquidity (eg bilateral transactions and quick tenders), so far these have hardly been necessary. In this sense, the new institution follows very much in the footsteps of the Bundesbank. Likewise, the low level of reserve requirements in the United States is probably the main reason for the comparatively high frequency of transactions. And in Japan, while the requirement is higher, it seems to be insufficient to offset the high volatility of autonomous factors. At the same time, other reasons may also be relevant. For example, in Japan, in addition to the variability of autonomous items, the comparative illiquidity of some market segments calls for a broad spectrum of instruments and hence, presumably, for a greater fragmentation in the operations. And it cannot be ruled out that in part the differences may simply reflect variations in style and historical precedent.

The *spectrum of instruments* at the disposal of the authorities is especially large in the case of the Bank of Japan, partly for the reasons just mentioned. Beyond this, probably the most noteworthy aspect is that in the three currency zones the most popular transactions are repurchase agreements. Repurchase transactions such as repos[42] are generally preferred to outright open market operations for several reasons: they do not require a liquid underlying market for securities;[43] they essentially have only an indirect impact on the price of the securities transferred, via the injection/withdrawal of liquidity and any associated signalling effects; and they break the link between the maturity of the paper and that of the transaction. The emergence and subsequent rapid growth of private repo markets in recent years, often encouraged by the central banks themselves, has further spurred the use of these instruments. At the same time, the repo transactions carried out by the central bank do not necessarily follow the same conventions, or occur in the same market, as those for private repos. This is true, for instance, of the repos used by the Eurosystem.[44]

The spectrum of eligible *collateral* is considerably broader in the euro area and Japan than in the United States. A range of both private and public sector instruments are eligible in the first two currency areas, while in the United States the set is normally restricted to direct obligations of the government or those fully guaranteed by federal government agencies. This basic choice reflects in part the state of development of the various markets and broader historical factors, including evolving views regarding the appropriate role of central bank operations in private and public sector instruments. A relevant question is whether the availability of collateral may at times complicate monetary policy implementation. In normal conditions, this is not the case. Nevertheless, in special circumstances, such as periods of severe market stress, operating frameworks based on a more limited set of collateral could conceivably run into constraints.[45] Thus, for instance, several countries

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[42] Depending on the legal and technical characteristics of the instrument, a distinction is often made between repos and buy-sellback transactions. The terms will be used interchangeably in what follows.

[43] On the other hand, they help to increase the liquidity of the underlying market.

[44] Except for the auction procedures, in the United States and Japan there do not seem to be any real material differences in the transactions and instruments employed.

[45] In Europe, collateral constraints became a relevant consideration in some countries during the ERM crisis in 1992, when abnormally large sterilisation operations were implemented in certain jurisdictions.

broadened the range of available collateral in the run-up to the Year 2000 century changeover. Some, such as the United States, did so on a temporary basis. Others, such as the United Kingdom, have taken the opportunity to do so on a permanent basis. Given the ample amount of collateral available in the euro area, no special steps were required in this respect. A question going forward is whether the prospective decline in the stocks of government debt in some countries, such as the United States, could induce a reconsideration of eligibility criteria. Interestingly, in March the Fed renewed the temporary extension of expanded eligible collateral until the end of January 2001.

The three operating frameworks also differ significantly with respect to the range of eligible *counterparties*. At one end of the spectrum, in the Eurosystem all credit institutions are eligible counterparties in regular tenders as long as some additional minimum operational requirements are fulfilled. At the other end, in the United States a restricted group of primary dealers, who must meet eligibility criteria, act as counterparties; in exchange for this privilege, they must fulfil, inter alia, a series of market-making obligations.[46] Japan falls somewhere in between, with counterparties varying depending on the type of transaction, but with a common requirement that the institution be recognised as a major player in the relevant market. This spectrum reflects different assessments of the relative merits of alternative arrangements. The framework in the Eurosystem was explicitly designed with a view to ensuring as broad a participation as some of its predecessor systems, notably the German one. Accordingly, one could consider counterparty status as the natural quid pro quo for being subject to reserve requirements. In contrast, most clearly in the US arrangements, perceived benefits in terms of operational efficiency and improved market functioning play a more significant role. At the same time, the differences are narrower for fine-tuning operations, for which the set of counterparties is also restricted in the Eurosystem in order to secure rapid and smooth execution.

III. Conclusions

The frameworks of monetary policy operating procedures in the United States, Japan and the euro area share some fundamental characteristics. The central banks steer very short-term interest rates closely through a mixture of clear signals and liquidity management operations. Liquidity management relies on reserve requirements with averaging provisions and on discretionary market operations. These operations are primarily, though not exclusively, effected through repurchase agreements. In these respects, the frameworks closely resemble those in place in other industrialised countries. They reflect a common long-term trend towards greater transparency and a stronger market orientation in policy implementation.

At the same time, certain differences can also be discerned with respect to signalling mechanisms and liquidity management procedures. The key signals of the Federal Reserve and the Bank of Japan are announcements of target rates for the overnight rate; the Eurosystem signals the desired level of short-term rates through regular fixed rate tenders. In principle, this should allow the Eurosystem somewhat greater freedom in tolerating deviations of the overnight rate from the tender rate if and when required by circumstances. So far, the overnight rate has been very close to the tender rate. As regards liquidity management, the Eurosystem relies somewhat more on standing facilities as end-of-day safety valves for liquidity imbalances at individual institutions; de facto, the Federal Reserve and the Bank of Japan operate (almost) exclusively through market operations. This could reflect a number of factors, including nuances in basic philosophy regarding the desirability of providing automatic relief, albeit at a price, for ineffective cash management at individual institutions and emergency liquidity connotations for some of the facilities (United States and Japan). The frequency of market operations is much higher in the United States and Japan. In addition to mirroring the different use of standing facilities, this appears to derive primarily from the characteristics of reserve requirements in the United States (low level and short averaging period) and from the high volatility of autonomous factors in Japan.

[46] The eligibility of counterparties for standing facilities in the United States and the euro area is essentially based on institutional criteria. In the euro area, the set coincides with that for regular tenders, although the operational criteria are somewhat different.

As mentioned at the outset of the paper, the three frameworks allow central banks to convey policy signals with the desired degree of clarity and to influence short-term rates with the desired degree of accuracy. In other words, if the proof of the pudding is in the eating, the three frameworks pass the test. This does not necessarily mean that the systems will not evolve further over time, just as they have in the past, in order to respond to changes in the financial and policy environment or to fine-tune the comparatively less effective elements of the arrangements. Indeed, one can be confident that this will be the case.

Postscript

Since the paper was completed for the conference in May 2000, a number of changes have taken place in the implementation frameworks in the three currency areas under examination. This short note describes the main ones.

Changes in the United States have been fairly minor. They have largely been driven by the decline in the stock of government debt associated with fiscal surpluses and by its impact on available collateral.[47] The Federal Reserve has once again renewed the measures broadening the set of eligible collateral, which are now due to expire in January 2002. In addition, since July 2000 the monetary authority has been operating under self-imposed caps on holdings of specific issues of treasury securities with a view to avoiding distorting the yields of those in scarce supply. The future of these measures will no doubt depend on the evolution of the stock of treasury debt. Other things being equal, further declines would favour their temporal extension and could, at some point, require that consideration be given to a permanent and/or additional broadening. At the same time, since autumn 2001 fiscal policy has been eased, making the prospective long-term reduction in government debt less certain.[48]

The most important change in the euro area relates to the pricing mechanism for the weekly tender operations. In order to address the structural component of the overbidding problem, from end-June 2000 the Eurosystem switched its main refinancing operation from a fixed to a variable rate (American) tender. Contrary to the conjecture made in the May paper, rather than relying more on the standing facilities to signal policy, the Eurosystem chose an innovative solution. Specifically, the main policy signal is now the preannounced minimum bid rate. This solution ingeniously retains the clarity and flexibility of the original fixed repo rate signal while enlisting market forces to deal with the overbidding problem. Even so, the measure does not address the component of over- and underbidding that reflects expectations of changes in policy rates during the maintenance period. In particular, during the recent protracted phase of entrenched expectations of policy easing, this has resulted in recurrent underbidding episodes. The central bank can in part deal with this by making it clear to the market that it does not stand ready to accommodate all of the liquidity shortage except at the higher (penalty) standing facility rate. However, in the long term, more structural remedies may be called for. As discussed in the paper, a reconsideration of the remuneration schedule on reserve requirements is one possible element of such a longer-term response.

It is in Japan that changes to the framework of monetary operations have been more extensive. At least three developments deserve attention: the introduction of a new lending facility; modifications to the arrangements concerning collateral, associated with the introduction of real-time gross settlement (RTGS); and the shift from an interest rate to a quantitative target.[49]

In March 2001, the Bank of Japan introduced a complementary lending facility (CLF). This is a lombard-type facility analogous to the marginal lending facility in place in the euro area. It provides end-of-day overnight[50] credit on demand at the discount rate, provided that the eligible institution has pre-pledged the necessary amount of collateral. The facility thus sets a ceiling for the overnight rate. Its introduction can be seen as the natural culmination of a process that started in July 1995, when the overnight rate was steered below the discount rate for the first time. The new facility has shed the emergency liquidity assistance connotations attached to the collateralised lending activated at the discretion of the Bank to promote the smooth functioning and stability of the financial system (see the main text). This has made sure that institutions would not be inhibited from using it. Following its

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[47] For a more general analysis of the implications of this trend across countries, see "The changing shape of fixed income markets: a collection of studies by central bank economists", *BIS Papers,* no 5, October 2001 and "Market functioning and central bank policy", *BIS Papers*, forthcoming.

[48] On the basis of an authorisation granted in 1999, the Federal Reserve has also made more routine use of long-term (28-day) repos rather than relying on rollovers and outright purchases of securities to meet seasonal and medium-term liquidity needs. This, however, appears to be a reflection not so much of the caps on individual issues but of a preference for repo operations more generally.

[49] For further details, in addition to the accompanying paper in this volume, see "Money market operations in FY 2000", *Market Review*, Bank of Japan, September 2001.

[50] The credit can be renewed for a maximum of five days.

introduction, the Federal Reserve is the only central bank in the group that still does not rely on lombard-type facilities.

RTGS naturally increases the demand for intraday credit and when such credit is provided against collateral, as in Japan or the euro area, it also raises the demand for collateral. Thus, in support of the introduction of RTGS in 2001, the Bank of Japan strengthened collateral arrangements. In particular, the Bank created a "standing collateral pool", supporting intraday credit, treasury fund settlements outright bill purchases and, according to current plans, the CLF (starting in December 2001). By breaking the link between the operations and specific assets backing them, the common pool permits the efficient use of collateral. It has been one reason for the increased reliance on bill purchases during fiscal year 2000.

The change that has no doubt attracted most attention, however, has been the shift from an interest rate to a quantitative target. The move was motivated by the extraordinary circumstances facing the Japanese economy. After following a zero interest rate policy between February 1999 and August 2000, the Bank of Japan followed positive interest rate targets (0.25% and 0.15%) until March 2001, when it switched to a target for current account balances.[51] At the same time, at least from an operational perspective, until the target was raised from JPY 5 trillion to JPY 6 trillion in August 2001, there was arguably little difference between the current account target and the previous zero interest rate policy. In fact, the total amount of current account balances kept in the system was very similar to that maintained in the previous phase, although its distribution, not under the Bank's direct control, differed somewhat. The subsequent increase in the target amount represented a significant change operationally. Even so, with interest rates already at zero, probably the impact of the shift was mainly psychological, underlining the central bank's willingness to add excess reserves into the system.

[51] This is not quite equivalent to a target for "excess reserves" since institutions other than those subject to reserve requirements have account balances at the Bank of Japan, notably tanshi companies (money market brokers) and securities dealers.

The main features of the monetary policy frameworks of the Bank of Japan, the Federal Reserve and the Eurosystem

Denis Blenck, Harri Hasko, Spence Hilton and Kazuhiro Masaki[1]

1. Introduction and summary

This paper presents the main aspects of the monetary policy instruments and procedures of the Bank of Japan, the Federal Reserve and the Eurosystem.[2] In particular, it describes the monetary policy objectives, the minimum reserve systems, the demand for central bank balances and the main autonomous factors affecting their supply, the types of open market operations, the standing facilities available, the range of counterparties able to participate in monetary policy operations, the eligible assets used as collateral and, finally, the overnight interbank markets, whose interest rates are strongly influenced by central bank policies.

The attached tables present simplified balance sheets and the main features of reserve requirement systems and open market operations of the three central banks. In addition, some charts are annexed, describing the development of the main official interest rates in the course of 2000 as well as the behaviour of the overnight rate in relation to both the amount of central bank balances and the monetary policy operations of the three central banks.

All three central banks share the same general framework for implementing monetary policy. Commercial depository institutions[3] request balances with the central bank to settle wholesale financial transactions and, in addition, reserve requirements are imposed on them to hold minimum balances over predefined maintenance periods. The supply of such balances is directly influenced by open market operations, arranged at the discretion of the central bank, but may also be influenced by a variety of autonomous factors outside the control of the central bank. In general, short-term rates are controlled by using open market operations to achieve an appropriate supply of balances relative to the demand. All three central banks have standing facilities so that commercial depository institutions may borrow directly from the central bank when balances are in short supply. While the three central banks share the same general framework for implementing policy, there exist many differences in institutional details and in specific operating practices. These differences are more a reflection of historical traditions than explicit design choices. In the past, all three central banks have adapted their institutional frameworks to changing circumstances, and in the future operating practices are expected to evolve further.

2. Objectives of monetary policy operations

The monetary policy operations of the three central banks considered here, particularly their open market operations, have a direct influence on the overnight interest rate applied to the trading of funds between financial institutions for the adjustment of their balances with the central bank. In Japan this

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[1] Denis Blenck and Harri Hasko: European Central Bank; Spence Hilton: Federal Reserve Bank of New York; Kazuhiro Masaki: Bank of Japan. The authors would like to thank Sandy Krieger, Atsushi Miyanoya and Francesco Papadia for their comments. The views and the information provided in the paper are not necessarily those of the European Central Bank, the Federal Reserve Bank of New York or the Bank of Japan. This paper is an updated version of a comparison of the three operational frameworks which was prepared for a conference on the operational framework of the Eurosystem held at the European Central Bank in May 2000.

[2] The Eurosystem refers to the European Central Bank and all 12 national central banks which are members of the euro area.

[3] The terms “banks”, “commercial depository institutions” and “credit institutions” are used interchangeably in this review.

interest rate is referred to as the call rate, in the euro area it is called the EONIA rate (euro overnight index average), and in the United States it is the federal funds rate. These interest rates are sometimes informally called interbank rates, although participation in these markets may not be limited to depository institutions.[4] Short-term interbank rates are one of the channels through which monetary policy decisions are transmitted to the economy, and two of the central banks currently set an explicit objective for the overnight interbank rate, commonly called the target rate.

Under normal circumstances, the main operating objective of open market operations conducted by the Bank of Japan (BOJ) is to keep the overnight call rate in line with the target set at each Monetary Policy Meeting of the Policy Board. In March 2001, the BOJ adopted new procedures for money market operations whereby the balance of current accounts held by financial institutions at the BOJ, instead of the overnight rate, is set at the operating target.[5] In either case, the target is announced to the public immediately after each meeting. In the Federal Reserve (Fed), the Federal Open Market Committee (FOMC) directs open market operations to meet a specified target for the overnight federal funds rate. After a meeting, the FOMC immediately announces whether a change in the target rate has taken place. The European Central Bank (ECB) does not have an official operating target. Generally, it signals the monetary policy stance through its regular main refinancing operations (MROs), executed in the form of either fixed or variable rate tenders. In the former the applied rate signals the monetary policy stance, while in the latter this is effected through a minimum bid rate.[6] Normally, the provision of central bank balances leaves the interbank rate near the midpoint of the band formed by the rates on the standing facilities.[7] This midpoint has coincided with the fixed rate of the main refinancing operation (after April 1999) or the minimum bid rate applied since the main refinancing operation has been conducted as a variable rate tender.

In all three central banks, open market operations, and certain other market-related activities, are carried out by a trading arm, hereinafter referred to as the "Trading Desk".[8] The Trading Desk at each central bank is directly accountable to the policymaking body.

3. Demand for central bank balances

The term "central bank balances" refers to the deposits of private financial institutions active in money markets that are held in accounts at the central bank, sometimes called current account balances. These balances are closely related to a concept of "reserves" which is used by all three central banks, but it is not identical in each case, as will be outlined below. In the Eurosystem and the Fed, central bank deposits are largely held by depository institutions subject to reserve requirements, although there are exceptions. At the BOJ, a broader set of financial institutions active in the money markets maintain accounts with the central bank, including securities companies, securities finance companies and money market dealers.[9]

Demand for central bank balances in each currency area may be divided into two broad categories: demand stemming from explicit reserve requirements, and all other sources of demand, sometimes

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[4] The overnight rate is of the greatest relevance for this discussion, although longer maturities are available in these markets, which are described in more detail in Section 9.

[5] The target balance was initially set at around JPY 5 trillion before it was increased to JPY 6 trillion in August 2001. Since these amounts are well above the required reserve balance (about JPY 4 trillion), the overnight call rate stays around zero under normal circumstances. As such, the new procedures intend to achieve the same monetary easing effect of a "zero interest rate policy", while preserving a market mechanism as much as possible. The BOJ announced that the new procedures would continue until the consumer price index registers either 0% or an increase year on year.

[6] The mechanics of open market operations are described in more detail in Section 5.

[7] The administration of the borrowing and lending facilities of the three central banks is reviewed in Section 6.

[8] As the Eurosystem has recourse to the national central banks of the euro area in carrying out open market operations, a Trading Desk, in the true sense, does not exist at the ECB.

[9] Balances held by some institutions that are active in the money markets are sometimes considered a factor that negatively affects the supply of reserves, but in this paper these holdings are treated as a positive component of the demand for central bank balances.

called demand for excess balances. As used in this paper, the concept of excess reserves includes balances held by financial institutions active in the money market that are not subject to reserve requirements.

3.1 Demand for central bank balances deriving from reserve requirements

All three central banks impose reserve requirements on depository institutions, which can be satisfied by holding balances at the central bank. The key features of the structure of reserve requirements are summarised in the first table of Annex 1. For the BOJ and the Eurosystem, reserve requirements can only be satisfied by holding balances at the central bank. For the Fed, in calculating the level of total required balances, allowance must be made for the portion that can be met with vault cash.[10] Banks within the Federal Reserve System may also establish a required clearing balance, which affects the demand for balances in a way that is virtually identical to reserve requirements.[11]

Reserve requirements plus, if any, clearing balance requirements are an important component in the institutional framework of all three central banks for driving interbank rates. Indeed, total required balances represent the largest source of demand for central bank balances, and they are known with complete certainty, at least before the maintenance period ends. The ability of banks to "average" their balance holdings within a maintenance period so as to meet requirements helps moderate the impact that daily variations in the actual supply of balances outside the control of the central bank would have on interbank rates.

Average levels of total required balances for 2000 are presented in Annex 1. By themselves, these aggregate values do not reveal the flexibility that banks subject to balance requirements have in averaging their holdings of central bank balances over a maintenance period. This flexibility depends on the level of requirements, in the aggregate and at the level of the individual institution, as well as on the length of each maintenance period, and must be measured against the volatility and unpredictability both of financial payment flows and of the aggregate supply of balances. In all three areas, the ability to average balances to meet requirements is limited by the prohibition on ending any given day in a debit position.[12]

3.2 Other demand for central bank balances

Normally, desired holdings are, on average, very close to the level of total required balances. They are never too low because there are penalties for failing to meet minimum reserve requirements, and they are never too high because excess balances earn no interest. But some other uses of central bank balances, beyond the need to meet requirements, generate demand for balances in excess of requirements, which Trading Desks must be able to anticipate by accurately steering interbank rates.

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[10] The Fed allows each bank to satisfy its reserve requirements with currency held on the bank's premises, which is referred to as vault cash. Each depository institution's level of "applied vault cash" in a maintenance period is calculated as the average value of the vault cash it held during an earlier computation period, up to the level of its reserve requirements. Thus, the level of applied vault cash is lagged and known prior to the start of each maintenance period. Applied vault cash is included in official measures of reserves.

[11] Banks may agree, at their discretion, to hold additional balances at the Fed within each two-week reserve maintenance period to meet a clearing balance requirement. Unlike the balances held to meet reserve requirements, banks are, de facto, remunerated at a market rate for the balances they hold to meet their clearing balance requirement. Explicit interest is not paid, but compensation is paid in the form of income credits that can be applied against charges for various priced services offered by the Fed. Banks are sometimes motivated to establish a clearing balance requirement in order to improve the flexibility they have in managing their accounts at the central bank without incurring the opportunity cost of holding (non-remunerated) excess reserves. All balances are held in a unified account. At the end of each two-week period, the Fed determines whether a bank has satisfied its clearing balance requirement, based on a bank's average holdings of balances that were not used to meet reserve requirements.

[12] The carry-over provisions, which are unique to the Fed, provide some flexibility for averaging balances across maintenance periods.

3.2.1 Payment and settlement-related uses of central bank balances

In all three currency zones, financial payments are settled when balances are transferred between the central bank accounts of financial institutions that are parties to a transaction. The settlement procedures and the closely related overdraft policies are described in this section, along with their impact on demand for central bank balances.

The transfer of central bank balances via electronic payment systems is the primary mechanism by which financial transactions are settled in all three currency areas. Fedwire in the Federal Reserve and TARGET (the Trans-European Automated Real-time Gross settlement Express Transfer system) in the Eurosystem are real-time gross settlement (RTGS) systems. Net settlement systems exist in both areas, but these other systems settle their end-of-day balances in central bank money through the above networks. In Japan, RTGS was introduced for the funds transfer system of BOJ-NET, the online-based settlement system that the BOJ provides, at the beginning of 2001. BOJ-NET is linked to separate networks for cheque clearing, yen-based foreign exchange transactions and interbank domestic funds transfers that are settled at designated times once a day. In the Fed and the Eurosystem, banks dominate the settlement process, acting as intermediaries for other financial institutions that do not have central bank accounts. At the BOJ, other financial institutions, which are not subject to minimum reserve requirements, can still hold central bank accounts and have direct access to BOJ-NET, through which they can effect the settlement of funds and government securities. However, membership of the networks for cheque clearing, yen-based foreign exchange transactions and interbank domestic funds transfers is limited to depository institutions.

All three of the central banks have adopted different policies to reduce their exposure to daylight overdrafts. In the euro area, the participating national central banks administer their own practices, which take one of two general forms. First, daylight overdrafts are permitted as long as adequate collateral is on hand at the national central bank in question. Second, the national central bank may provide intraday credit through repurchase agreements (through an automatic mechanism) with no interest charged. In all cases, at the end of a day, any remaining debit positions are automatically treated as a request for use of the Eurosystem's marginal lending facility.

In the Fed, daylight overdrafts are permitted, subject to caps. Securities-related overdrafts can be excluded from the caps by pledging collateral. A fee of 27 basis points (quoted on an 18-hour day) is charged against an institution's average daylight overdraft position. A penalty of 4 percentage points in excess of that day's effective federal funds rate is applied against any end-of-day overdraft. Larger banks typically opt to cover these overdrafts by borrowing at the discount window. However, some smaller banks either may not actively manage their accounts late in the day or may not have collateral pledged to the window and may, occasionally, end the day with an overdraft and pay the penalty rate.

Under the newly introduced RTGS system, the BOJ extends intraday credit to counterparties in the form of daylight overdrafts against eligible collateral that has been pledged in advance. No interest is charged on the overdrafts. For financial institutions that fail to clear overdrafts at the end of the day, a penalty rate (6 percentage points in excess of the official discount rate) is applied. In practice, however, most of the major counterparties are entitled to access the Complementary Lending Facility,[13] through which the BOJ extends loans at the official discount rate upon request, thereby avoiding end-of-day overdrafts.[14]

Since daylight overdrafts are granted by the BOJ against eligible collateral, demand for eligible assets has increased dramatically. Against this background, the BOJ established, upon the introduction of RTGS, a "standing collateral pool" against which daylight overdrafts are extended to counterparties. The standing collateral pool allows counterparties to use eligible assets very efficiently.[15]

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[13] The Complementary Lending Facility was introduced in the middle of March 2001. In terms of purposes and functions, it is very similar to the marginal lending facility of the ECB.

[14] Unlike the ECB, debit positions at the end of the day are not automatically treated by the BOJ as a request for use of the Complementary Lending Facility. Financial institutions that want to use the Facility have to make requests to the BOJ by the deadline, currently set at 30 minutes before the closing time of BOJ-NET.

[15] In the standing collateral pool, a linkage between the BOJ's credit and specific assets is not required as long as the total value of the eligible collateral in the pool is large enough to cover the exposure of the counterparty concerned. As a result, substitution of collateral, including across various types of financial assets, is widely permitted. The standing collateral pool is also used as collateral for the outright purchase of bills.

The concentration of settlement transactions at particular times of the day can give rise to strong demand for intraday balances, depending on how binding daylight overdraft policies are. In all three currency areas, total required balances are usually sufficient to satisfy even the highest intraday demand for balances, although this is difficult to measure objectively. But on some days, when settlements of payments are particularly heavy, demand for higher levels of excess balances does seem to appear in all three areas, although to a lesser extent in the euro area. However, the higher daily demand for balances on these days can usually be offset with lower balances on other days within the maintenance period, and banks end up holding, on average, minimal levels of excess balances.

3.2.2 Other sources of demand for excess balances

Institutions that do not have access to immediately available funds in the interbank market may hold levels of balances in excess of requirements as a precautionary source of liquidity to meet contingencies. This may apply, in particular, to smaller banks. In the Fed, excess balances are held predominantly by smaller institutions and for many years have averaged about USD 1 billion (currently about 10% of total balances). In the Eurosystem, excess reserve holdings as a portion of total balances are much lower (in the order of 0.5% to 0.7% of total reserves). This is likely to be due to the possibility of making overnight deposits with the Eurosystem at the end of the day. In all three areas, the opportunity cost of holding balances in excess of requirements usually keeps their demand to a minimum, as long as the reserve requirement is well above the balances that are needed for a smooth settlement of funds. But when the opportunity cost effectively becomes zero, as in Japan at the moment, the demand for excess balances may become extremely large. Accordingly, the very high levels of excess balances provided by the BOJ throughout 1999 until mid-August 2001 coincided with an interest rate of practically zero.

4. Main autonomous factors affecting the supply of central bank balances

Autonomous factors outside the direct control of the Trading Desk affect the available supply of balances at all three central banks. In large measure, open market operations are designed to neutralise their effects. Each central bank devotes resources to forecasting their movements so as to help calibrate its operations. In the case of the BOJ, forecasts of key factors for the following day are released to the public every evening. In the Eurosystem, when the MRO is announced the ECB also publishes a forecast of the expected liquidity needs of the banking system for the period from the day of the announcement until (and including) the day before the settlement of the following main refinancing operation.

In the case of the Fed and the BOJ, where daily swings in autonomous factors are larger relative to the size of the balances, the central banks conduct market operations almost every day in order to smooth liquidity conditions. In the Eurosystem, on the other hand, where central bank balances are large enough to absorb daily fluctuations of autonomous factors, the ECB usually intervenes in the market once a week. Because of the differences in levels of balances, the behaviour of autonomous factors is most relevant on a daily horizon for the BOJ and the Fed, while the weekly horizon is the most relevant for the ECB.

The balance sheets of all three central banks, presented in Annex 2, itemise the major autonomous factors for each bank. The composition of each balance sheet reflects a host of historical circumstances unique to each central bank. However, in all three cases, the largest single liability is banknotes in circulation (currency). Banknotes in circulation are also fairly volatile in all three areas (Annex 3). Currency movements follow strong seasonal patterns in all three areas (although experience at the ECB is still fairly limited), which improves their predictability. Nevertheless, in the euro area and the United States this factor is relatively difficult to predict on a daily basis.

Perhaps the most volatile factor at all three central banks is the Treasury balance, or government deposits. In absolute size, government deposits are normally very small in the Fed, and of moderate size at the BOJ and in the Eurosystem. But their magnitude can swing dramatically around peak government payment or receipt dates. The ECB and the Fed report that this factor is perhaps the most difficult one to forecast on a short-term basis, even though dates when government inflows and outflows are highest are known well in advance. In the case of the BOJ, the Treasury funds are

projected fairly precisely in most cases, since all funds transactions related to the Treasury are conducted through the BOJ. Even so, swings in the Treasury funds are often significant relative to the level of the required balances, leading to some difficulties in conducting market operations.

The ECB and the Fed report that the "float", or items in the process of collection, can also be volatile and difficult to predict. The BOJ and the Fed also maintain deposit or investment facilities for foreign central banks, which are autonomous factors affecting the supply of reserves that can be difficult to predict. In the Eurosystem, some national central banks also manage deposits or investment facilities for foreign central banks and international organisations, but these amounts are relatively stable and the size of their daily fluctuations is fairly predictable.

5. Open market operations and operational practices

Open market operations are the main instruments used in steering interest rates and managing liquidity in all three currency areas, as recalled above. The BOJ is the most active in this field, conducting operations more than once a day. The Fed typically acts in the market daily, while the Eurosystem usually conducts open market operations only on a weekly basis (see Annex 4 for a comparison of the open market instruments).

5.1 The Bank of Japan

The open market operations of the BOJ can be classified in two broad categories: fund-providing and fund-absorbing operations. Several market instruments can be used for providing temporary liquidity, such as purchases of short-term government bills or commercial paper under repurchase agreements. Temporary liquidity provision also takes the form of borrowing of securities against cash collateral (so-called JGB repos). In addition to these types of operations, the BOJ also conducts outright purchases of bills, against the standing collateral pool.[16] Among all the instruments mentioned above, purchases of short-term government bills under repurchase agreements are the most frequently used. The maturity of all these operations ranges, in most cases, from one week to three months, although it can be extended, except for purchases of commercial paper, to six months (operations with a maturity of less than one week are also available). As regards more permanent funds provision, the BOJ conducts outright purchases of government bonds regularly (currently twice a month), so that the amount bought is consistent with the net increase in banknotes in the long run. For short-term funds provision, there has been a shift of emphasis from open market operations using commercial bills to those using government securities. The instruments used for absorbing funds are mainly sales of short-term government bills under repurchase agreements and outright sales of bills issued by the BOJ.

All operations are conducted through multiple price (American) auctions and settlement can be on the same day or on some future date. The instruments used for same day settlement are purchases or sales of government bills under repurchase agreements, outright purchases of bills, or BOJ bill sales. As the purpose of the open market operations is to guide the level of the overnight rate, there is no attempt to affect any particular market in which the operations are conducted; instead, practical considerations influence the choice of instruments to be used.

The interbank market opens at 8.30 am. At around this time the Director of the Financial Markets Department and other staff concerned from the Trading Desk meet to decide on the details of the operations to be conducted on the day. At 9.20 am, the BOJ announces the operations being settled on the same day. Operations that are being settled on future dates are announced at 9.30 am, 10.10 am or 12.10 pm, depending on the types of instruments. In most cases, propositions for operations are collected within an hour of the announcement, and auction results are released as

[16] For outright purchases of bills, the BOJ purchases "master bills" (bills issued by a counterparty only for the purpose of the BOJ's operations) backed by the standing collateral pool. Therefore, in terms of their function, the bill purchasing operations can be considered a variety of the BOJ's loan against the pooled collateral, for which interest rates are determined through competitive auctions.

soon as possible thereafter. The interbank market usually closes at 5 pm (on the days when government bills/bonds are issued in the market, the closing time is extended by 60 or 90 minutes depending on the types of securities issued).

5.2 The Federal Reserve

The Fed conducts its open market operations in Treasury securities and debt obligations of government agencies and government-sponsored enterprises. A multiple price (American) auction format is used for all transactions. Repurchase agreements on these securities are used to add reserve balances on a temporary basis. The maturities of the repurchase agreements range from overnight to three months. In practice, most repurchase agreements are under one week and overnight is the most common maturity. However, over the past year the Fed has increasingly used term repurchase agreements of about 28 days to help meet underlying reserve needs and to offset seasonal swings in currency and other autonomous factors. Repurchase agreements are predominantly for same day settlement, but forward operations are sometimes arranged. The Trading Desk exercises considerable judgement in selecting the specific maturities of the repurchase agreements it uses to address day-to-day reserve needs, recognising that the same daily pattern of reserve supply can be achieved through many combinations of repurchase agreements of different size and maturity. When draining reserves on a temporary basis, the Fed, for operational convenience, uses mainly matched sale-purchase agreements of Treasury bills, overnight being the most common maturity. These are, however, arranged far less frequently than repurchase agreements. Outright purchases of Treasury securities in the secondary market are used to increase reserves on a permanent basis. The specific issues purchased are chosen on the basis of broad portfolio considerations. For operational convenience, each outright purchase of securities is limited to either bills or to a specified maturity range of coupon-bearing issues.

The interbank market opens informally at 8 am. At 9.10 am, there is an informal telephone discussion between staff at the New York Fed and at the Board of Governors, reviewing forecasts and presenting the Trading Desk's proposed market actions, shortly after a complete set of reserve estimates is first available. At 9.20 am, a conference call begins with the participation of staff at the New York Fed, staff of the Board of Governors and a regional Reserve Bank President who is a voting member of the FOMC. Money market conditions and reserve projections are reviewed, and the Manager's proposed open market actions are presented to the FOMC representative for approval.

Most temporary operations that are designed predominantly to affect the supply of reserves on a particular day are usually arranged in the morning around 9.30 am, to take advantage of the greater market liquidity at that time. The timing of permanent operations is more flexible. Most outright purchases are arranged for next day settlement and are executed before noon, after which time the futures market for Treasuries closes and the cash market for Treasuries becomes less liquid. However, operations arranged for same day delivery-versus-payment settlement must be completed prior to the closing of the securities wire transfer system at 3 pm. The interbank market for federal funds closes at 6.30 pm. The direction and duration of the projected reserve imbalances drive the choice of operations.

5.3 The Eurosystem

Although the Eurosystem also has a wide variety of market instruments available to affect the level of reserve balances, so far it has resorted almost exclusively to its regular operations. Of these, the main refinancing operations, are the most important, since they are the only ones used to signal the stance of monetary policy. They are executed every week and have a maturity of two weeks. The other regular operations, with a maturity of three months, are aimed at providing longer-term financing to the counterparties. The latter operations provide approximately 25% of the reserve supply by the ECB. Until June 2000 the main refinancing operations were executed through fixed rate tenders. However, as a reaction against severe overbidding which had occurred under the fixed rate tender procedure, the Eurosystem decided to switch to variable rate tenders with a multiple rate (American) auction format from the end of June 2000. The minimum bid rate announced for these operations signals the monetary policy stance, which was previously indicated by the fixed rate. Longer-term operations have always been executed in the form of variable rate tenders (using the American auction method). In these latter operations, the ECB does not send signals to the market and therefore normally acts as a rate-taker. Longer-term operations are executed regularly each month.

In addition to regular operations, the Eurosystem can also conduct fine-tuning operations and structural operations. The fine-tuning operations can be executed in the form of reverse operations, foreign exchange swaps, outright purchases or sales and the collection of fixed-term deposits. Fine-tuning reverse transactions, foreign exchange swaps and the collection of fixed-term deposits are normally to be executed through quick tenders, although the possibility of using bilateral procedures is not excluded. Outright purchases or sales are conducted through bilateral procedures. The Eurosystem may also execute structural operations in the form of reverse transactions or the issuance of debt certificates aimed at adjusting the structural liquidity position of the Eurosystem vis-à-vis the financial sector.

A wide range of collateral is accepted for the operations. The regular operations are usually settled on T+1, while the fine-tuning operations can be settled on the same day.

The euro area interbank money market opens at 9 am CET. A Liquidity Committee, consisting mainly of liquidity managers and senior management of the ECB's Directorate General Operations and Directorate General Economics, meets every day at 10.15 am to discuss market developments and the liquidity situation. Every Tuesday two Executive Board members participate in the meeting of the Liquidity Committee, which on that day makes a proposal to the Executive Board on the allotment in the main refinancing operation. On Tuesday morning, counterparties have to submit their bids to their national central bank by 9.30 am. The bids are then sent to the ECB to be compiled by the ECB's Front Office at 10.35 am. The Executive Board's allotment decision is published via wire services at 11.20 am. The interbank market closes at 6 pm CET.

6. Standing facilities

The Eurosystem provides its counterparties with two standing facilities: one for providing and one for draining reserves, which also set a corridor for the fluctuations of the overnight interest rate. The BOJ recently introduced a standby lending facility, known as the Complementary Lending Facility, which is designed to complement market operations initiated by the BOJ. The Fed does not offer facilities for draining reserves and also uses more discretion than the Eurosystem in providing funds for temporary liquidity needs of counterparties.

6.1 The Bank of Japan

In March 2001, the Bank of Japan introduced the Complementary Lending Facility, through which it extends loans to counterparties at their request against eligible collateral. The official discount rate is applied to the loans. The maturity of the credit is overnight, although it can be extended up to five business days. Since the official discount rate is higher than the operating target for the overnight call rate, it provides a ceiling on the overnight call rate.

In order to access the Facility, counterparties have to make a request to the BOJ 30 minutes before the closing time of the funds settlement system of BOJ-NET.[17]

Collateral for the Facility is currently managed separately from the standing collateral pool, which is used for daylight overdrafts as well as bill purchasing operations. Types of collateral accepted for the Facility are basically the same as those for the standing collateral pool, although some types of financial assets, such as commercial bills, are excluded for technical reasons. By the middle of December 2001 the collateral for the Facility will be fully merged with the standing collateral pool, enabling counterparties to use eligible collateral more efficiently.

In addition to the Complementary Lending Facility, the BOJ can also extend loans to counterparties against eligible collateral at its own discretion, if deemed necessary, to ensure the smooth functioning and stability of the financial market.

[17] The deadline will be extended by 15 minutes in the middle of December 2001 when computerised procedures are introduced.

6.2 The Federal Reserve

Borrowing at the Federal Reserve's discount window may be used to meet temporary liquidity needs arising from short-term fluctuations in assets and liabilities. All institutions subject to reserve requirements have access to the discount window, including domestic commercial banks, US branches and agencies of foreign banks and savings institutions. The Fed provides discount loans at its own discretion. Borrowing must be for an approved reason – typically to avoid unexpected overnight overdrafts or unexpected shortfalls that would leave the institution deficient in meeting reserve requirements. Institutions must seek other reasonably available sources of funds before turning to the discount window.

Each of the 12 regional Reserve Banks operates a discount window facility for eligible institutions in its district, subject to the same policies in all districts. The maturity of the credit is mostly overnight. The rate is the basic discount rate approved by the Board of Governors.

In addition to ordinary discount window loans, the Fed also provides seasonal borrowing programmes for small institutions and an extended credit facility for banks experiencing longer-term liquidity needs arising from exceptional circumstances.

6.3 The Eurosystem

The Eurosystem provides two standing facilities, a marginal lending facility and a deposit facility. There are two ways to access the marginal lending facility: first, at the end of the day, any remaining intraday debit positions of counterparties on their settlement account with the national central bank are automatically considered a request for use of the facility. Second, counterparties may also access the marginal lending facility on their own initiative by making a request to the national central bank during the day or, at latest, 30 minutes after the actual closing of time of TARGET. All credit institutions subject to reserve requirements can, in principle, access the marginal lending facility. The interest rate applied is currently 1 percentage point higher than the minimum bid rate of the main refinancing operation. There is no limit to the amount of credit that can be extended against eligible assets. Since the maturity of the credit is overnight, in normal circumstances, the marginal lending rate provides a ceiling for the overnight rate. Each of the 12 national central banks within the Eurosystem operates the marginal lending facility for eligible institutions in its country. The Governing Council of the ECB exercises authority over the administrative procedures to ensure uniform practices across the euro area.

As regards the deposit facility, counterparties can use it to make overnight deposits with national central banks. The interest rate of the deposit facility provides, in normal circumstances, a floor for the overnight market interest rate. Currently the rate of the deposit facility is 1 percentage point lower than the minimum bid rate of the main refinancing operation. To access the deposit facility, the counterparty must send a request to the national central bank during the day or, at the latest, 30 minutes after the actual closing time of TARGET. Counterparties fulfilling the general eligibility criteria may access the deposit facility.

7. Counterparties

The Fed and the BOJ both have relatively few counterparties, less than 100, even if the range of eligible institutions in both countries is wider than in the euro area. As regards the Eurosystem, all of the approximately 7,500 credit institutions subject to reserve requirements are eligible, in principle, to participate in the regular operations and standing facilities of the Eurosystem. But less than half of them fulfil the operational criteria required by the national central banks for accessing monetary policy operations and only about 600 institutions actually participated in them in 2001.

7.1 The Bank of Japan

The counterparties of the BOJ differ somewhat, depending on the type of operation in question, but all of them fall into one of the following categories: banks, securities companies, securities finance companies and money market brokers (Tanshi companies). Furthermore, all must have a current account at the BOJ. Additional conditions that counterparties need to meet are that they have access

to BOJ-NET, that their creditworthiness satisfies certain standards and that they are recognised as major players in the money market.

Depending on the type of operation, the number of counterparties varies from about 30 to 50.[18] They are selected and reviewed about once a year, through a public application process based on selection guidelines that are publicly disclosed. Counterparties are expected to bid actively on the BOJ's offer, to process transactions expeditiously and accurately and to provide market information or analysis useful to the BOJ in implementing monetary policy.

7.2 The Federal Reserve

For open market operations, the Fed relies on a well defined set of counterparties, called primary dealers, of which there are currently about 25. Primary dealers must be either a commercial banking organisation or a registered securities dealer in good standing with their regulator, and they must comply with minimum capital standards. Financial institutions that comply with the primary dealer requirements are eligible to apply to become a counterparty.

Primary dealers are expected to provide satisfactory performance in three areas: to make reasonably good markets for the Fed Trading Desk's open market operations, to provide meaningful support for the issuance of US Treasury securities (including participation in primary auctions) and to communicate market information to the Trading Desk on conditions in financial markets valuable in the formulation and implementation of monetary policy.

7.3 The Eurosystem

All credit institutions subject to minimum reserve requirements are, in principle, eligible counterparties of the Eurosystem, assuming that some basic requirements are met. The most important of these are that the credit institutions must be financially sound, be subject to harmonised supervision by national authorities and fulfil the operational criteria specified by the relevant national central banks (eg hold a securities settlement account for liquidity-providing operations). Counterparties participating in fine-tuning operations must meet some additional requirements, the most important of which are activity in the money market as well as trading desk efficiency and bidding potential.

Currently, about 7,500 credit institutions are subject to reserve requirements; more than 3,000 of these have access to standing facilities and about 2,500 are eligible for participation in regular open market operations. About 200 of them have been selected by the national central banks to participate in fine-tuning operations.

8. Eligible collateral[19]

All credit operations with the three central banks have to be covered by collateral. Although the spectrum of eligible collateral is broadest in the euro area, government securities represent the bulk of eligible assets in all three currency areas.

8.1 The Bank of Japan

Different types of assets are eligible for the monetary policy operations and other types of credit of the Bank of Japan.

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[18] All types of market operations are conducted at the BOJ's headquarters except for the outright bill purchasing operations at all offices, a type of operation that was introduced in July 2001 in order to facilitate smooth provision of funds across the nation. In this type of operation more than 120 financial institutions, including a large number of regional banks, are eligible as counterparties.

[19] An article published in the April 2001 issue of the *ECB Monthly Bulletin* gives more detailed information on the eligible assets available in the euro area.

- The standing collateral pool is used for both daylight overdrafts and bill purchasing operations. After the reform taking place by the middle of December 2001, it will also cover the BOJ's credit extended through the Complementary Lending Facility. Owing to such versatility, the standing collateral pool is also referred to as the "common collateral". Types of collateral to be accepted in the standing collateral pool are stipulated in the Guidelines on Eligible Collateral, which prescribe principles concerning the BOJ's collateral policy. They include not only public debt, such as government bonds/bills, government-guaranteed bonds, municipal bonds and foreign government bonds (denominated in yen), but also private debt, such as commercial bills, corporate bonds, asset-backed securities and loans on deeds, the eligibility of which is examined by the BOJ in advance.
- For repurchase agreements, the BOJ accepts commercial paper issued by non-financial companies and short-term government bonds.
- For borrowing of securities against cash collateral (JGB repos), long-term government bonds (10-year, 20-year) as well as medium-term government bonds (two-, four-, five- and six-year) are accepted as eligible assets.

8.2 The Federal Reserve

The range of assets accepted by the Fed as collateral in its open market operations is comparatively narrow but the outstanding supply is much greater. It encompasses direct obligations of the US Treasury and securities that are direct obligations of, or fully guaranteed as to principal and interest by government agencies, including government-sponsored enterprises. Within this set of collateral, the Trading Desk may not accept securities with certain characteristics, such as structured notes, for operational reasons. The Fed's counterparties, the primary dealers, collectively hold roughly USD 1.5 trillion of Fed-eligible securities that they finance through repurchase transactions. The outstanding supply of these securities is much larger, perhaps as much as four times this amount.

By contrast, the Fed accepts a wide range of assets at the discount window. In addition to the assets already mentioned, these include certain collateralised mortgage obligations, obligations of state and other political subdivisions, corporate bonds, one- to four-family residential mortgage notes and commercial, industrial or agricultural notes. A common list of assets eligible for the discount window is used by the 12 Federal Reserve Banks. Given the diverse nature of discount collateral, it is very difficult to estimate the supply of eligible collateral, but it is quite clear that it is much greater than the amount of collateral eligible and available for open market transactions.

8.3 The Eurosystem

The Eurosystem accepts the same type of collateral for both its open market operations and the marginal lending facility, as well as for intraday credit for payment systems purposes. In order to take account of the still existing differences in the financial structure across member states, assets eligible for the credit operations of the Eurosystem encompass a very wide range of different instruments. Notably, in addition to marketable debt instruments, non-marketable debt instruments and even some equities are eligible. No distinction is made between these assets in terms of quality, and all fulfil the minimum eligibility criteria of the Eurosystem. All types of eligible assets can be used indiscriminately for monetary policy operations by all counterparties across the euro area. In total there are approximately EUR 6.4 trillion of eligible assets.

Essentially for purposes internal to the Eurosystem, however, a distinction is made between two categories of eligible assets, referred to as "Tier 1" and "Tier 2":

- Tier 1 consists of assets fulfilling uniform euro area-wide eligibility criteria established by the ECB.
- Tier 2 consists of additional assets for which eligibility criteria are established by the national central banks, subject to the minimum eligibility criteria established by the ECB.

9. Key financial markets in the implementation of monetary policy

Since the policy rate in Japan and the United States is the announced level of the overnight interest rate, the most important market in defining the stance of monetary policy in these countries is the uncollateralised overnight money market. The Eurosystem, too, pays close attention to the behaviour of the overnight rate, although this is not an operational target of the Eurosystem.

9.1 The Bank of Japan

The major participants in the uncollateralised overnight call money market are the city banks which have the largest share as borrowers, while regional banks act as major lenders. Other important players include investment trusts, trust banks and specialised money market brokers. Most trades are settled on the same day, although settlement on T+1 and T+2 is also possible. The most closely related markets to the uncollateralised overnight market are the collateralised call market and euro-yen market.

Because of the wide fluctuations in the autonomous factors and the lack of a single market which is liquid enough, the BOJ conducts monetary policy operations in several markets. The most important of these are the market for short-term government bills, the repo market and the market for commercial paper. A relatively large weight has been attached to operations in the market for short-term government bills, because of the recent rapid growth of this market.

9.2 The Federal Reserve

In the United States the uncollateralised overnight market is called the federal funds market. It is the interbank market for direct transfers and trades of balances in Federal Reserve accounts. Most large trades are arranged through brokers and trading is dominated by large banks. Many of these maintain correspondent relations with other institutions, with which they may directly arrange federal funds trades. Smaller banks typically arrange trades directly with counterparties, rather than through the brokers. The vast majority of wholesale transactions are for same day settlement and carry a maturity of one business day. But forward trades and term transactions, though generally short-term, are common. In recent years, the daily volume of overnight transactions arranged through major brokers has averaged between USD 50 billion and USD 70 billion.

The most closely related market that participants can use for borrowing and lending is the market for overnight eurodollar transactions, which are unsecured dollar-denominated transactions that settle on the accounts of offshore institutions. The rates in the two markets are usually identical. The domestic repo market may also serve as an alternative financing market. The availability of collateral creates some differences in interest rates and participants between the markets.

Most open market operations are conducted in the repo market for government securities. The largest cash lenders in this market include, among others, mutual funds, corporations, insurance companies and municipal authorities. The largest routine borrowers of cash are government securities dealers. Banks are able to participate in the repo market, but the collateral requirement can be a limiting factor. Settlement is mostly on the same day, but forward transactions are common. Maturities range from overnight to one year, although shorter-term transactions are the most common, especially overnight. The trading volume averages around USD 600 billion per day.

9.3 The Eurosystem

The key instrument in signalling the stance of monetary policy of the Eurosystem is the main refinancing operation, the maturity of which is two weeks. However, the Eurosystem also pays very close attention to the overnight market, as evidenced by the fact that the two standing facilities of the Eurosystem set a corridor for the fluctuation of the overnight rate. The overnight market is by far the most active and the overnight reference rate (EONIA), which is calculated by the ECB, is widely used in interbank transactions (ie through the overnight interest rate swap market).

The uncollateralised overnight money market is largely characterised by a two-tier structure, ie larger banks, also acting across the border, act as intermediaries for the smaller banks. The interbank money market is essentially an over-the-counter market and involves few intermediaries such as brokers.

Settlement normally takes place on T+2 for deposit, repo and swap transactions, with the exception of overnight and tom/next transactions, which are settled on T and T+1 respectively. The bulk of the transactions take place at the very short end of the money market curve. According to the data available, it is estimated that the overall average volume of daily transactions of the largest banks amounts to approximately EUR 60 billion.

The two most closely related markets used by participants for borrowing and lending are the repo market and the foreign currency swap market. Each of them is estimated to represent slightly less than half the size of the unsecured money market. As regards the repo markets, mutual funds, corporations, insurance companies and other institutional investors act as cash lenders/borrowers, together with credit institutions.

10. Conclusion

The operational frameworks used by the Bank of Japan, the Federal Reserve and the European Central Bank for implementing monetary policy rely on similar fundamental characteristics. They allow the three central banks to clearly signal their monetary policy stance, even if the tools at work are different, and to steer closely short-term money market interest rates, which are the operational instrument. Open market operations are the main instrument for implementing monetary policy but, owing to the weight of tradition, the different sizes of the refinancing needs and the non-comparable features of the minimum reserve systems, the type and frequency of open market operations vary widely between the three central banks. They share the desire to remain neutral towards the financial markets, but the approaches chosen to achieve this objective are quite different. The Federal Reserve conducts regular operations in a limited set of markets for relatively small amounts; the Bank of Japan has diversified the set of markets in which it operates to spread the large amount and very high frequency of monetary policy operations it carries out; the European Central Bank executes weekly operations for large amounts without referring to any specific market segment, owing to the very wide range of assets taken as collateral. The technical features of the open market operations, as well as those of the standing facilities used by the three central banks, are therefore quite different. But the structural changes at work in the respective financial markets, such as the growing role of the repo market in Japan and the euro area and the shrinking public debt in the United States, should trigger further adaptations of the operational frameworks of the three central banks. This may facilitate a convergence of their operational procedures and practices, thus reinforcing the analogies which derive from their similar fundamental principles.

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Annex 1

Key elements of reserve requirements

	Bank of Japan	European Central Bank	Federal Reserve
Covered institutions	Depository institutions (city banks, regional banks, etc)	All credit institutions	Depository institutions (banks, thrifts, etc)
Covered liabilities having a non-zero requirement ratio and some other liabilities	Time deposits, other deposits, bank debentures, money in trusts, and foreign currency deposits	Overnight deposits, deposits with a maturity of up to two years, debt securities with a maturity of up to two years, and money market paper	Transactions deposits
Key requirement ratios	Ratios range from 0.05% to 1.20%	2% on all the above liabilities	10% top marginal requirement ratio applies to most deposits
Maintenance period structure	One month, starting on the 16th day of each month and ending on the 15th day of the following month	One month, starting on the 24th calendar day of each month and ending on the 23rd day of the following month	Two-week periods, beginning on every other Thursday
Required reserve computation period	Partly lagged. Based on average deposits over the entire calendar month in which the maintenance period begins	Fully lagged. Based on balance sheet data from the end of the nearest calendar month preceding the start of the maintenance period	Fully lagged. Based on average deposits in the two-week period beginning 30 days before the start of the corresponding maintenance period.
Eligible assets for satisfying requirements	Central bank balances held during the maintenance period only.	Central bank balances held during the maintenance period only	Central bank deposits held during the maintenance period, plus vault cash (up to the level of requirements) held during the required reserve computation period.
Remuneration on assets held to satisfy requirements	None	Interest is paid at the average rate of the ECB's main financing operations over the maintenance period	None
Carry-over provisions	None	None	Up to 4% of requirements of one maintenance period may be met with balances held in the following period; balances in excess of 4% of requirements in one period may be applied to meeting requirements in the following period
Penalty structure for failing to meet reserve requirements	3.75 percentage points plus the official discount rate	2.5 percentage points plus the marginal lending rate. Banks typically opt to borrow at the marginal lending facility instead	2 percentage points plus the discount rate is levied against reserve deficiencies beyond the carry-forward amount. Banks typically opt to borrow at the discount window instead.
Penalty structure for ending a day in overdraft	A penalty of 6% plus the official discount rate is applied to the any account deficit at the end of the day. The Complementary Lending Facility, in which the official discount rate is applied, is preferred instead.	Debit positions at the end of a day are automatically considered as a request to the marginal lending facility	A penalty of 4% plus the average federal funds rate for the day is applied to any account deficit at the end of each day. Larger banks typically opt to borrow at the discount window instead

Average reserve levels for maintenance periods (2000)

	Bank of Japan in trillions of yen	European Central Bank in billions of euros	Federal Reserve in billions of dollars
Reserve requirements	4	112	40
Applied vault cash	.	.	36
Required clearing balances	.	.	6
Total required balances	4	112	10
Total balances above requirements (excess)	1.1[1]	0.7	1

[1] Includes about 0.4 trillion yen of excess reserves at institutions subject to reserve requirements and about 0.7 trillion yen of balances held by financial institutions not subject to requirements.

Annex 2

Bank of Japan's balance sheet

Assets

(in billions of US dollars, exchange rate: USD 1 = JPY 100)

Items	Application to BOJ	30 March	30 June	30 Sept	30 Dec
1. Cash/coins	Cash	3	3	3	2
2. Gold	Gold	4	4	4	4
3. Foreign exchange reserve	Foreign exchange	37	38	35	37
4. Liquidity provisions as monetary policy operations		833	705	697	820
(1) Temporary liquidity provisions		436	332	367	507
a. Regular operations/lending conducted at the central bank's discretion	Outright purchase of commercial bills[1]	20	5	18	40
	Purchases of commercial paper under repurchase agreements	39	19	12	36
	Purchases of Treasury bills (TBs)/financing bills (FBs) under repurchase agreements	289	243	255	248
	JGB repos	79	62	81	184
	Loans	–	–	–	–
	Outright purchase of TBs/FBs	8	2	–	–
(Securities sold under repurchase agreements)	(Sales of TBs/FBs under repurchase agreements)	(21) <off-balance sheet>	(6)	(–)	(4)
b. Lending/discount facilities used upon request of financial institutions	Commercial bills discounted, etc	0	0	0	0
(2) Permanent liquidity provisions	Outright purchase of JGBs[2]	397	373	330	312
(securities held outright)	(Sales to government agencies or other institutions under repurchase agreements)[3]	(77) <off-balance sheet>	(100)	(147)	(180)
5. Other liquidity provisions	Other loans[4]	13	8	7	7
	Loans to Deposit Insurance Corp	3	–	0	1
6. Securities acquired through operations other than open market operations	FBs (underwritten)	52	3	8	3
7. Other financial assets	Deposits with agencies	36	9	11	1
	JGBs in custody[5]	77	60	80	180
	Other financial assets	6	8	8	10
8. Other assets (non-financial)	Premises and equipment	2	2	2	2
Total assets		1,066	837	856	1,068

[1] The BOJ purchases "master bills" (with maturity of less than six months) issued by financial institutions for short-term liquidity provisions. Master bills must be collateralised by eligible assets such as eligible commercial bills issued by non-financial institutions, certificates of JGBs, book-entry government bonds, etc. [2] Figures include TBs underwritten in exchange for JGBs (long-term government bonds) at their maturity (converted into shorter issues). [3] The BOJ sells JGBs that have been acquired through outright purchase operations to government agencies (Trust Fund Bureau of the Ministry of Finance, etc) and foreign central banks under repurchase agreements for investment facilities. [4] Loans to financial institutions other than those used for monetary operation purposes. Most of these are loans to financial institutions that are facing temporary liquidity problems. [5] Until March 2001, JGB repo transactions were double-counted on both sides of the balance sheet. When supplying liquidity by JGB repo operations, JGB transactions were appropriated as "JGBs in custody" on the asset side and "JGBs borrowed" on the liability side, while cash transactions were appropriated as "cash collateral" on the asset side, and "current deposits" on the liability side.

Liabilities and capital side

Items	Application to BOJ	30 March	30 June	30 Sept	30 Dec
1. Banknotes in circulation	Banknotes	571	553	557	634
2. Current account deposits of financial institutions		183	52	52	68
(1) Reserve deposit (required and excess reserves)	Reserve balances Excess reserve	132	45	52	54
(2) Required clearing balances	None	–	–	–	–
(3) Other balances	Deposits held by institutions NOT subject to the reserve requirement system, etc[1]	51	7	0	14
3. Liquidity absorption as monetary policy operations		38	51	22	28
(1) Deposit facility	None	–	–	–	–
(2) Bills and certificates issued	BOJ bills sold	38	51	22	28
(3) Reverse transactions	None	–	–	–	–
4. Government deposits	Deposits of the Japanese government	130	64	89	94
5. Other deposits	Foreign central bank account	0	0	0	0
6. Other liabilities and capital	JGB securities borrowed	77	60	80	180
	Accrued liabilities, capital, reserves, etc	67	57	56	64
Total liabilities and capital		1,066	837	856	1,068

[1] Securities companies, securities finance companies, money market brokers (Tanshi companies), etc.

Federal Reserve's balance sheet

Assets

(in billions of US dollars)

Items	Application to Fed	30 March	30 June	30 Sept	30 Dec
1. Cash/coins		0.5	0.7	0.8	0.9
2. Gold		11.0	11.0	11.0	11.0
3. Foreign exchange reserve[1]		14.5	14.6	15.3	15.4
4. Liquidity provisions as monetary policy operations		525.8	532.5	529.2	555.3
(1) Temporary liquidity provisions		24.0	27.4	17.7	43.5
a. Regular operations/lending conducted at the central bank's discretion	RPs outstanding	23.7	26.9	17.3	43.4
b. Lending/discount facilities used upon request of financial institutions	Loans to depository institutions (discount window, special liquidity facilities, etc)	0.2	0.5	0.4	0.1
(2) Permanent liquidity provisions (securities held outright)	Securities bought outright[2]	501.9	505.1	511.5	511.8
5. Other liquidity provisions		0	0	0	0
6. Securities acquired through operations other than open market operations		0	0	0	0
7. Other financial assets[3]		29.3	27.8	27.8	29.4
8. Other assets (non-financial)[4]		1.4	1.4	1.4	1.5
Total assets		582.6	588.0	585.6	613.5

[1] Measured at original cost. [2] Permanent liquidity provisions correspond to total securities, including securities on loan. Excludes securities sold and scheduled to be bought back under matched sale-purchase agreements with foreign accounts. These amounts were USD 17.8 billion on 30 June, USD 18.5 billion on 30 September, and USD 39.2 billion on 31 December. [3] Calculated as a residual. [4] Bank premises.

Liabilities and capital side

Items	Application to Fed	30 March	30 June	30 Sept	30 Dec
1. Banknotes in circulation	Federal Reserve notes[1]	534.9	541.9	538.8	563.5
2. Current account deposits of financial institutions		18.2	18.5	17.6	19.0
(1) Reserve deposit (required and excess reserves)		-	–	–	–
(2) Required clearing balances		–	–	–	–
(3) Other balances		–	–	–	–
3. Liquidity absorption as monetary policy operations		0	0	0	0
(1) Deposit facility	None	0	0	0	0
(2) Bills and certificates issued	None	0	0	0	0
(3) Reverse transactions		0	0	0	0
4. Government deposits		4.4	6.2	8.5	5.1
5. Other deposits		0.3	0.3	0.3	1.6
6. Other liabilities and capital[2]		24.8	21.1	20.4	24.2
Total liabilities and capital		582.6	588.0	585.6	613.5

[1] Banknotes in circulation excludes about USD 27.0 billion of Treasury currency outstanding. [2] Calculated as a residual.

Consolidated Eurosystem's balance sheet

Assets

(in billions of US dollars, exchange rate: EUR 1 = USD 0.9388)[1]

Items	Application to Eurosystem	End-March[2]	End-June[3]	End-Sept[4]	End-Dec[5]
1. Cash/coins	Coins of the euro area	0.9	0.9	0.9	0.9
2. Gold	Gold and gold receivables	108.6	113.8	117.3	109.9
3. Foreign exchange reserve[1]	Net foreign reserve assets (claims denominated in foreign currency - liabilities denominated in foreign currency - counterpart of the special drawing rights allocated by the IMF)	250.1	245.5	261.5	238.9
4. Liquidity provisions as monetary policy operations		189.4	220.2	216.2	252.2
(1) Temporary liquidity provisions					
a. Regular operations/lending conducted at the central bank's discretion	Open market operations (main refinancing operations + longer-term refinancing operations + fine-tuning/structural reverse operations + other lending)	189.3	220.1	216.2	251.6
b. Lending/discount facilities used upon request of financial institutions	Marginal lending facility	0.1	0.1	0.0	0.6
(2) Permanent liquidity provisions (securities held outright)	Structural/fine-tuning outright transactions	–	–	–	–
5. Other liquidity provisions	None	–	–	–	–
6. Securities acquired through operations other than open market operations	(1) General government debt denominated in euros	55.4	55.4	55.3	54.1
	(2) Securities of the euro area denominated in euros	23.8	23.6	24.1	24.4
7. Other financial assets		41.3	42.6	42.9	41.2
8. Other assets (non-financial)		41.0	41.4	39.1	43.6
Total assets		710.5	743.2	757.3	765.3

[1] Exchange rate at 29 December 2000. [2] Figures from *Weekly Financial Statement* published at the end of March (data from 31 March 2000). [3] Figures from *Weekly Financial Statement* published at the end of June (data from 30 June 2000). [4] Figures from *Weekly Financial Statement* published at the end of September (data from 29 September 2000). [5] Figures from *Weekly Financial Statement* published at the end of December (data from 29 December 2000).

Liabilities and capital side

Items	Application to Eurosystem	End-March	End-June	End-Sept	End-Dec
1. Banknotes in circulation	Banknotes	326.6	334.0	333.1	348.6
2. Current account deposits of financial institutions		103.3	112.9	107.9	116.7
(1) Reserve deposit (required and excess reserves)	Reserve balances + excess reserves	103.0	112.7	107.7	116.6
(2) Required clearing balances	None	–	–	–	–
(3) Other balances	Deposits held by institutions not directly contributing to the reserve requirement[1]	0.3	0.2	0.2	0.1
3. Liquidity absorption as monetary policy operations					
(1) Deposit facility	Deposit facility	1.0	0.1	0.4	0.2
(2) Bills and certificates issued	Debt certificates issued[2]	5.9	5.9	4.3	3.6
(3) Reverse transactions	None	–	–	–	–
4. Government deposits	Liability to general government denominated in euros	45.7	57.8	51.0	50.1
5. Other deposits	None	–	–	–	–
6. Other liabilities and capital[2]	Liabilities to non-euro area residents denominated in euros, other liabilities to euro area residents denominated in euros, revaluation accounts, capital and reserves, and other liabilities	227.9	232.6	260.6	246.0
Total liabilities and capital		710.5	743.2	757.3	765.3

[1] Current account holdings from institutions that are not subject to minimum reserve requirements or that, although being subject, do not have to fulfil them because they are below the lump sum allowance or because they use an intermediary for that purpose. [2] Debt certificates issued by several national central banks before the start of European Monetary Union and therefore inherited from Stage 2.

Annex 3

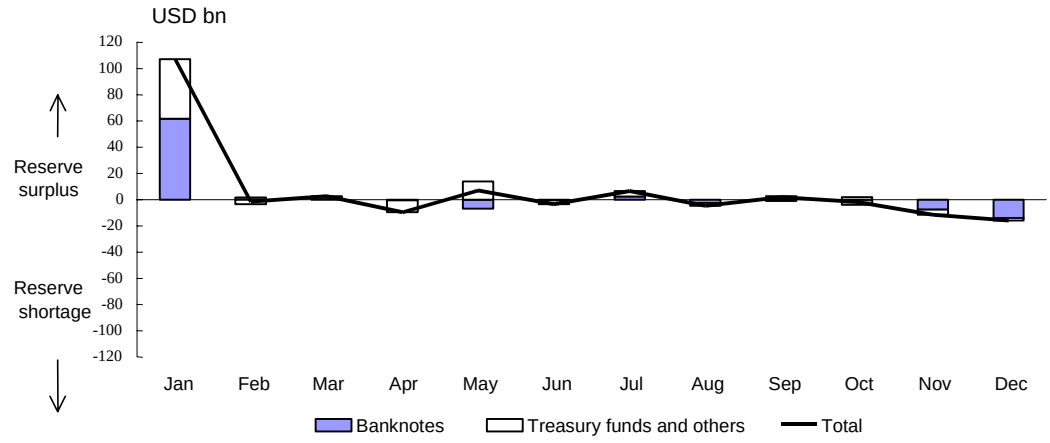
Daily changes in key autonomous factors affecting the supply of balances (2000)

Average/maximum absolute change in daily level in the indicated period	Bank of Japan All of 2000 in millions of US dollars	European Central Bank All of 2000 in millions of US dollars	Federal Reserve All of 2000 in millions of US dollars
Banknotes	2,966/20,275	534/3,006	931/8,087
Treasury balance (government deposits)	8,030/64,223	1,926/20,192	1,404/23,434
Float (items in the course of settlement)	.	268/2,122	839/9,677

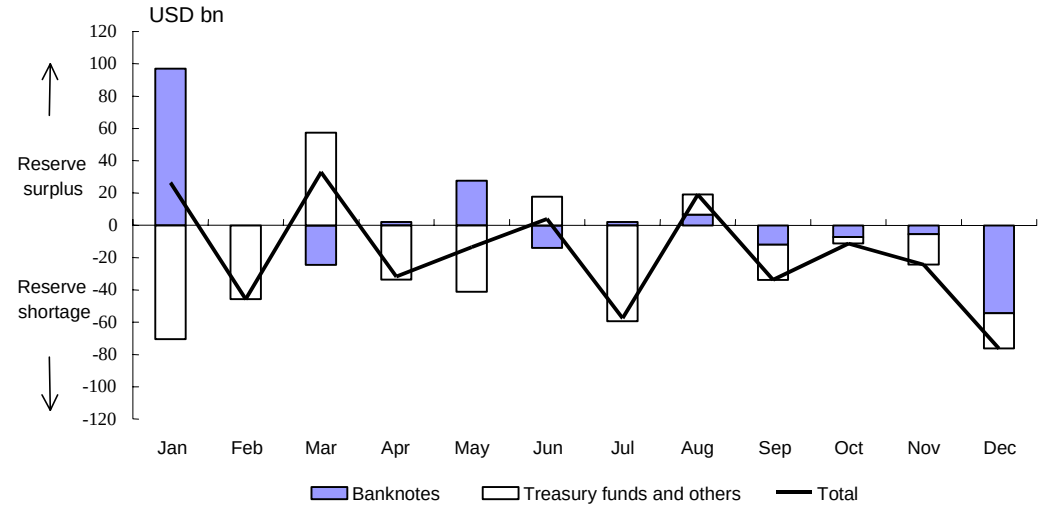
Note: Exchange rates taken on 29 December 2000: EUR 1 = USD 0.9388, USD 1 = JPY 114.35.

Comparison of autonomous reserve factors (2000)

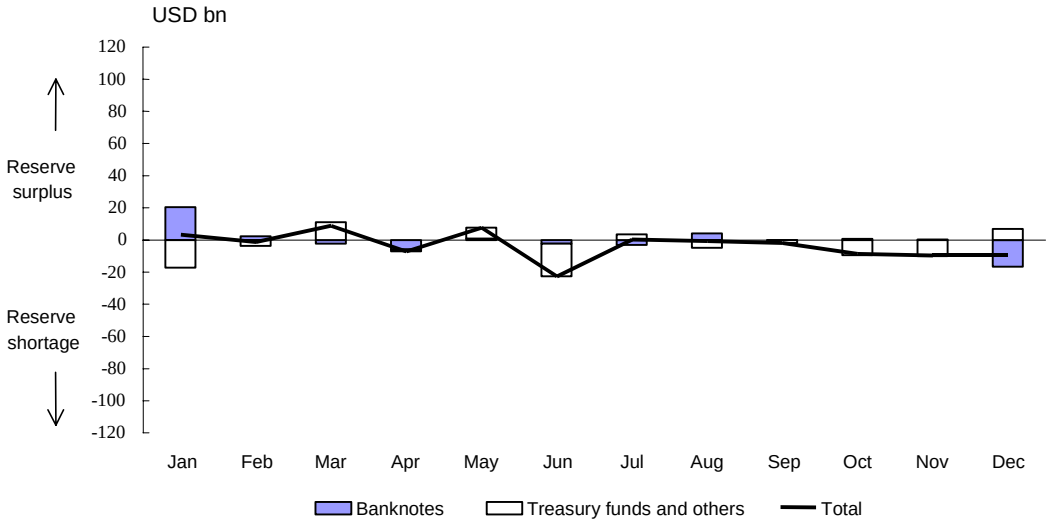
Federal Reserve



Bank of Japan



Eurosystem



Note: (a) Using publicly available information ECB: *Consolidated financial statement of the Eurosystem*; Fed: *Factors affecting reserve balances*; BOJ: *Sources of changes in current account balances at the Bank of Japan* (monthly). (b) To calculate the monthly change in autonomous factors, the following identity is applied: Change in the amount outstanding of market operations (including loans and other facilities) + change in autonomous factors = change in reserve balances. Then, the monthly change in autonomous factors is further divided between two categories: changes due to "banknotes" and changes due to "Treasury funds and others". (c) A "reserve surplus" indicates that the change in autonomous factors over the month has been liquidity-providing. A "reserve deficit" indicates that the change in autonomous factors over the month has been liquidity-drawing. (d) All figures are shown in billions of dollars. Exchange rates taken on 29 December 2000: EUR 1 = USD 0.9388, USD 1 = JPY 114.35.

Annex 4

Bank of Japan

Monetary policy operations

	Instruments	Legal structures	Purposes	Rollover or not	Maturity	Eligible assets to be purchased/sold	Settlement conventions	Counterparties	Notes
Fund provision operations	Outright purchases of JGBs	Outright	Permanent	Can be exchanged for new issues at maturity (replacement)	JGBs (2Y,4Y,5Y,6Y,10Y, 20Y)		Forward only	Banks Securities companies	Exchanged for JGBs (10Y) or TBs (1Y) <converted into shorter issues>
	Outright purchases of TBs/FBs		Temporary	In principle redeemed at maturity (no replacement)	TBs, FBs		Forward only	Banks Securities companies Tanshi	Used as a means of short-term funds injections
	Purchases of bills			Depending on reserve condition	Within 6 months	Master bills (collateralised by eligible assets)[1]	Same day and forward	Banks Securities companies Tanshi	Master bills are designed and issued by financial institutions for the open market operations
	Purchases of CPs under repurchase agreements	Repurchase			Within 3 months	Eligible CPs	Forward only	Banks Securities companies Tanshi	
	Purchases of TBs/FBs under repurchase agreements				Within 6 months	TBs, FBs	Same day and forward	Banks Securities companies Tanshi	
	JGB repos	Securities borrowing				JGBs (2Y,4Y,5Y,6Y,10Y, 20Y)	Forward only	Banks Securities companies Tanshi	
Fund absorption operations	Outright sales of TBs/FBs	Outright	Temporary	Depending on reserve condition	TBs/FBs held outright by the BOJ		Forward only	Banks Securities companies Tanshi	
	Sales of BOJ bills				Within 3 months	Bills issued by the BOJ	Same day and forward	Banks Securities companies Tanshi	BOJ bills are allowed to be traded only among interbank participants
	Sales of TBs/FBs under repurchase agreements	Repurchase			Within 6 months	TBs/FBs held outright by the BOJ	Same day and forward	Banks Securities companies Tanshi	

[1] Eligible commercial bills (including CPs) issued by non-financial institutions, certificates of JGBs, book-entry government bonds, corporate bonds, loans on deeds, asset-backed securities, etc.

Federal Reserve

Monetary policy operations

	Instruments	Legal structures	Purposes	Maturity	Rollover or not	Eligible assets	Settlement conventions	Counterparties	Notes
Fund provision operations	Outright purchases	Outright	Permanent addition to Fed balances	Duration of underlying security	Can be rolled over for newly auctioned issues at maturity	Treasury securities and direct or guaranteed obligations of government agencies and government-sponsored enterprises	Usually next day. Same day and skip day have been used	Primary dealers[1]	Purchase of Treasury bills and coupon issues are usually arranged in separate operations. Purchases of agency debt have not been made since 1981
	System repurchase agreements	Repurchase agreement	Temporary addition to Fed balances	Up to 65 days	No	Treasury securities and direct or guaranteed obligations of government agencies and government-sponsored enterprises	Usually same day; forward operations are sometimes made	Primary dealers	The FOMC sets guidelines for specific collateral that can be accepted
Fund absorption operations	Outright sales	Outright	Permanent drain to Fed balances	-	-	Treasury securities and direct or guaranteed obligations of government agencies and government-sponsored enterprises	Same day is possible	Primary dealers	Only Treasury bills have been sold in any quantity in the market. Last arranged in 1989
	Matched sale-purchase transactions	Sale and repurchase	Temporary drain to Fed balances	Unlimited	No	Treasury securities and direct or guaranteed obligations of government agencies and government-sponsored enterprises	Same day	Primary dealers	In practice, only Treasury bills are used

[1] See the complete definition in Section 7.2 of the main text.

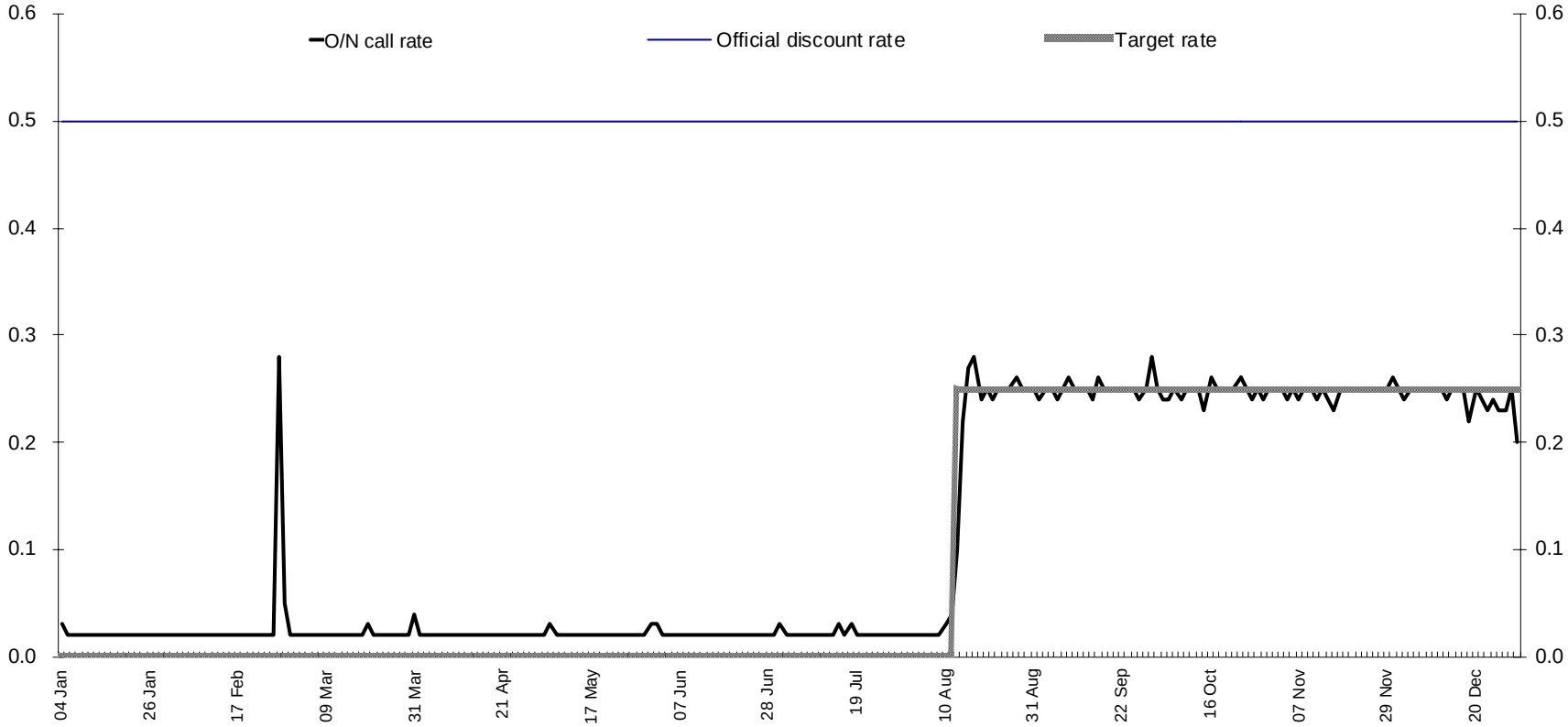
European Central Bank

Monetary policy operations

	Instruments	Legal structures	Frequency	Procedure	Rollover or not	Maturity	Eligible assets to be purchased/sold	Settlement conventions	Counterparties	Notes
Fund provision operations	Main refinancing operation (MRO)	Reverse transactions	Weekly	Standard tenders	Yes, but not necessarily for the same amount	2 weeks	Both Tier 1 and Tier 2 assets	T+1	Eligible credit institutions (2,500 institutions)	Fixed rate tenders were conducted from 1 January 1999 to 20 June 2000. Variable rate tenders have been conducted from 27 June 2000
	Longer-term refinancing operation (LTRO)		Monthly		Yes, but not necessarily for the same amount	3 months				Variable rate tenders (American auctions since March 1999)
	Fine-tuning / structural reverse transactions		Non-regular	FT: Quick tenders; bilateral procedures ST: Standard tenders	No	Non-standardised		T	Eligible credit institutions (200 institutions)	Used once on 21 June 2000
	Fine-tuning / structural outright purchase	Outright		Bilateral procedures			Only Tier 1 assets	Market conventions	No restriction a priori	
	Fine-tuning foreign exchange swap	Swap		Quick tenders; bilateral procedures			–	T, T+1, T+2	Eligible credit institutions (100 institutions)	
	Marginal lending facility	Reverse transaction	Access at the discretion of counterparties			Overnight	Both Tier 1 and Tier 2 assets	T	Eligible credit institutions (3,000 institutions)	
Fund absorption operations	Fine-tuning foreign exchange swap	Swap	Non-regular	Quick tenders; bilateral procedures	No	Non-standardised	–	T, T+1 or T+2	Eligible credit institutions (100 institutions)	
	Fine-tuning; collection of fixed term deposits	Deposit					–	T	Eligible credit institutions (200 institutions)	Used once on 5 January 2000
	Fine-tuning reverse transaction	Reverse transaction		Bilateral procedures			Both Tier 1 and Tier 2		Eligible credit institutions (200 institutions)	
	Fine-tuning/ structural outright sale	Outright					Only Tier 1	Market conventions	No restriction a priori	
	Structural issuance of debt certificates			Standard tenders		< 12 months	–	T+1	Eligible credit institutions (2,500 institutions)	
	Deposit facility	Deposit	Access at the discretion of counterparties			Overnight	–	T	Eligible credit institutions (3,600 institutions)	

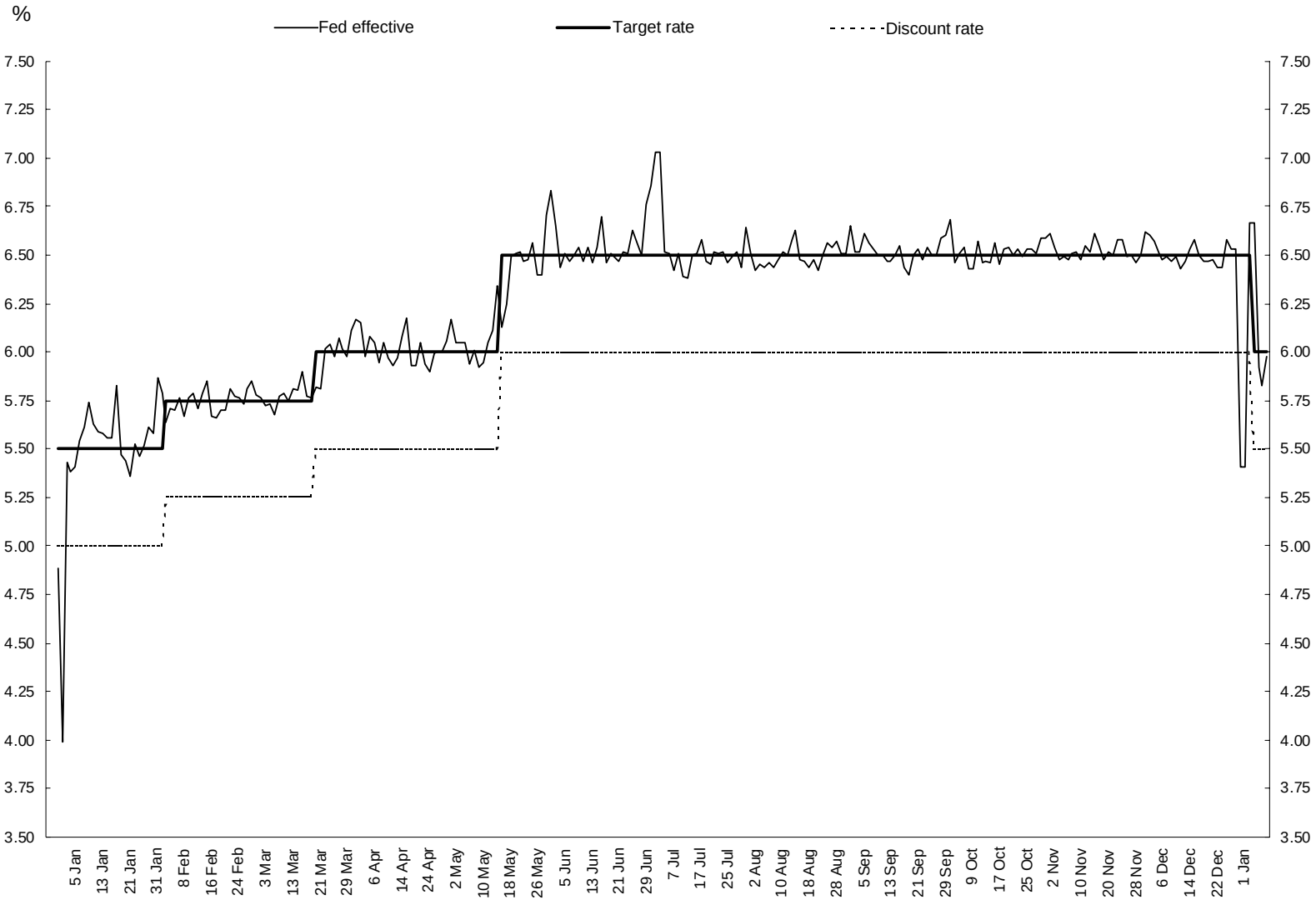
Annex 5

Bank of Japan - key rates (2000)

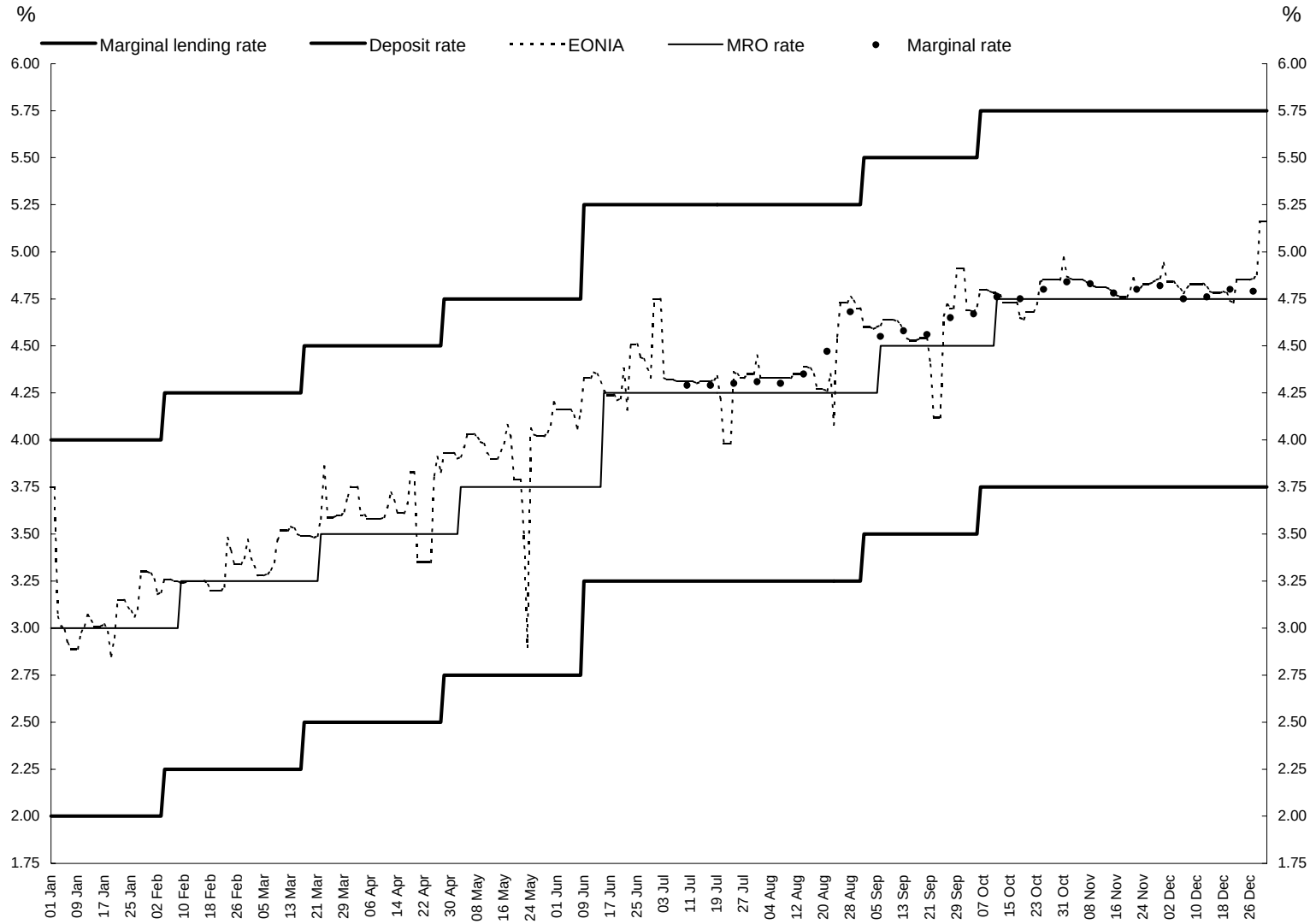


Note: BOJ changed main operating target from overnight call rate to current account balances as at 21 March 2001.

Federal Reserve - key rates (2000)

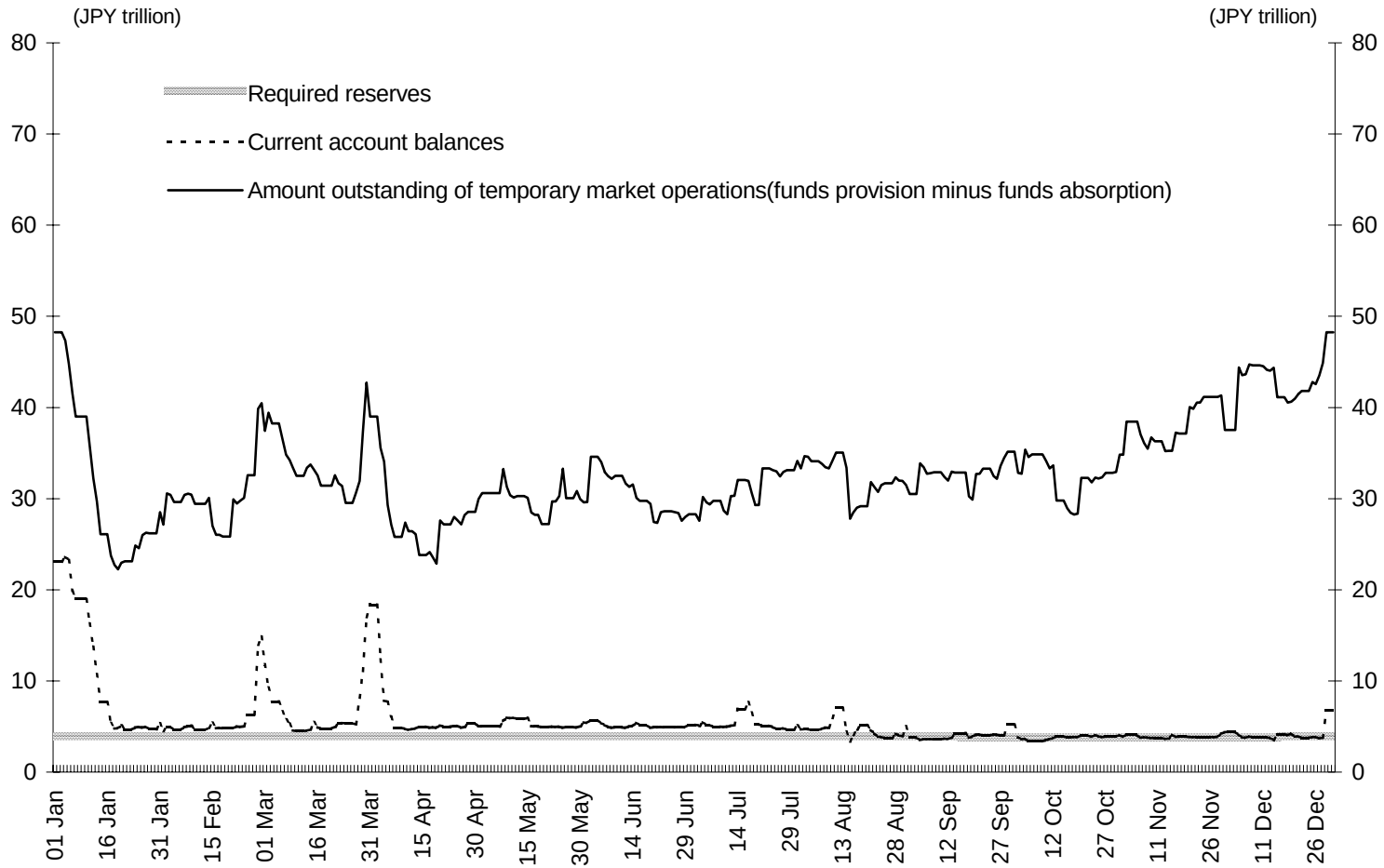


European Central Bank - key rates (2000)

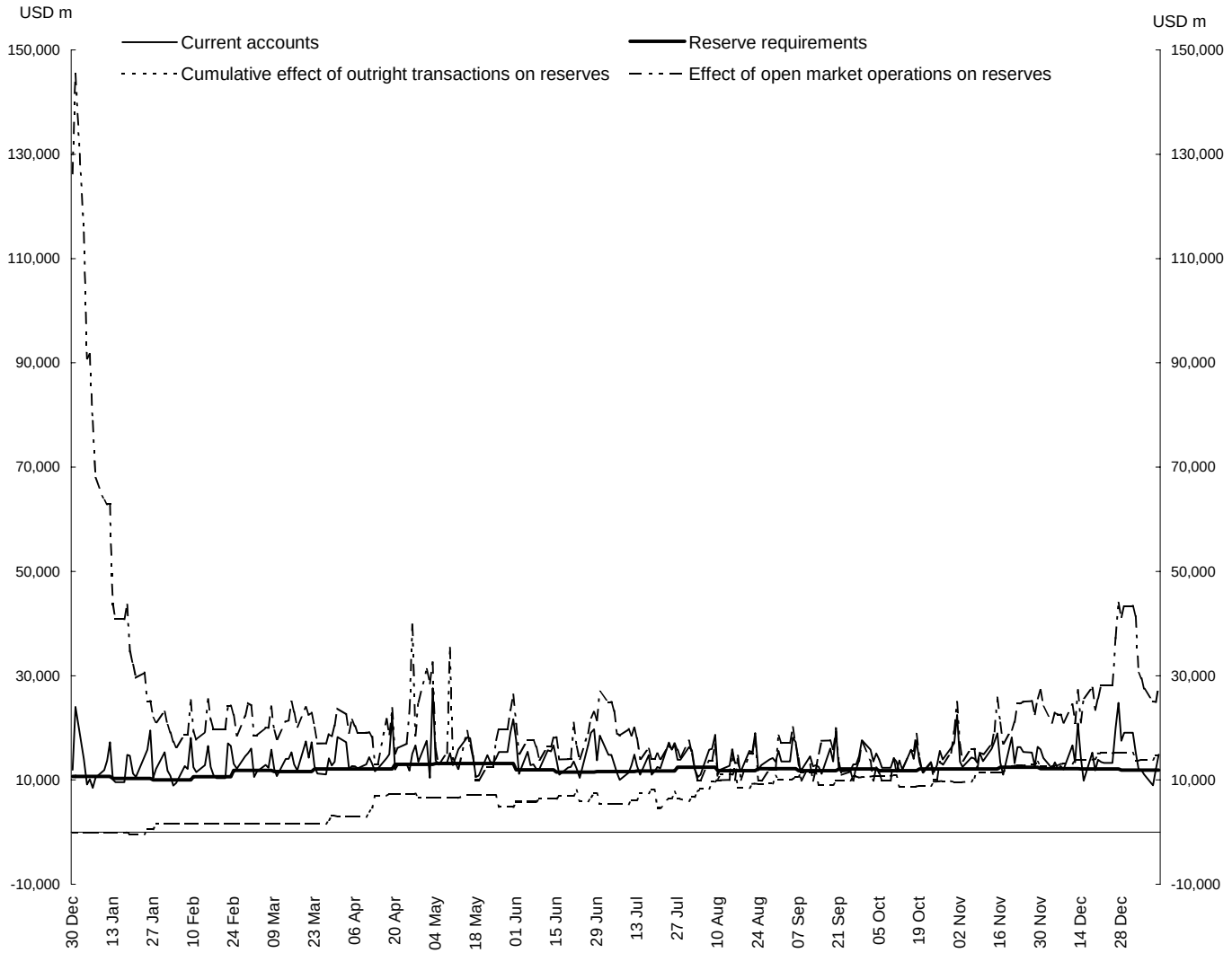


Annex 6

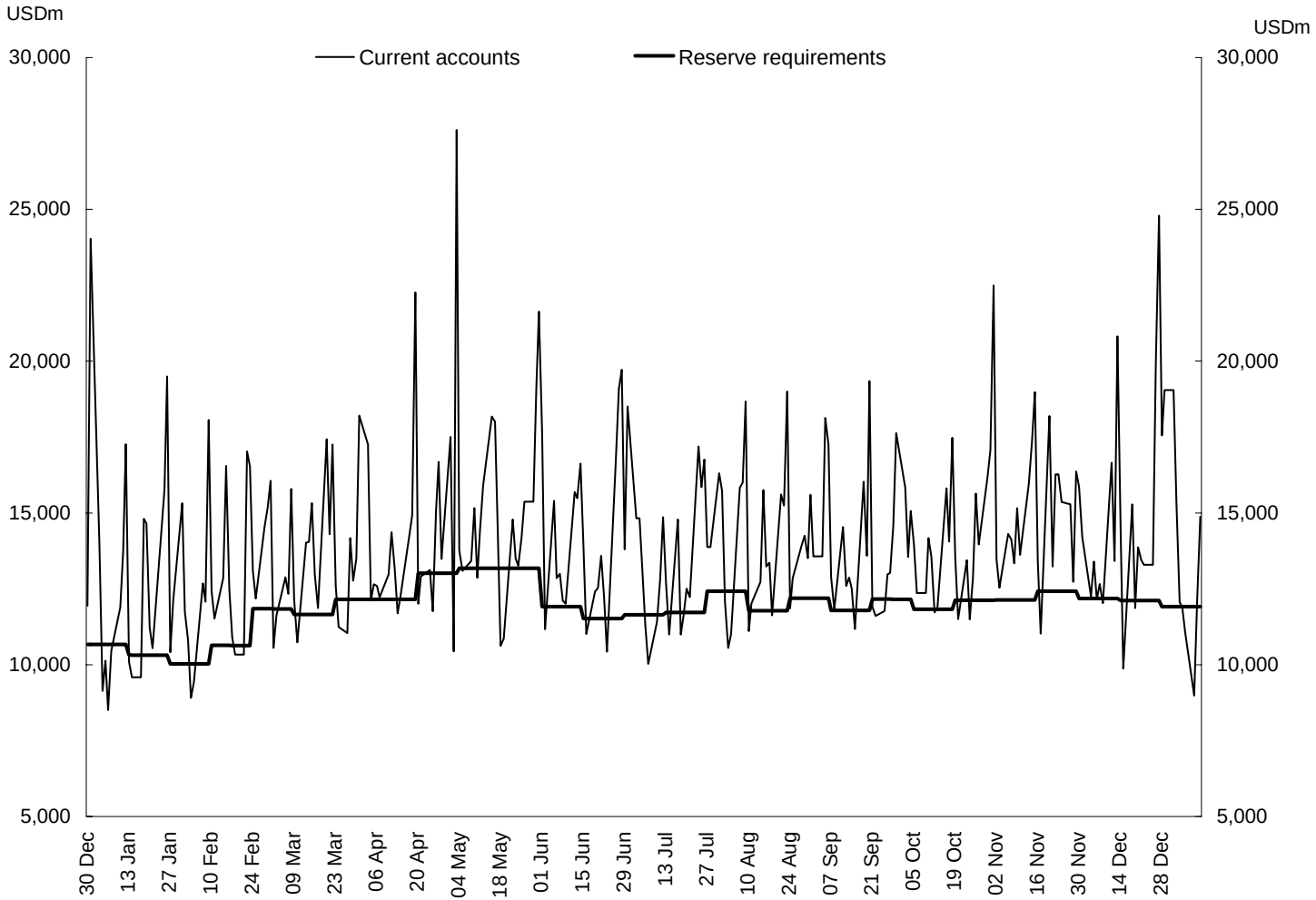
Bank of Japan - banking system liquidity (2000)



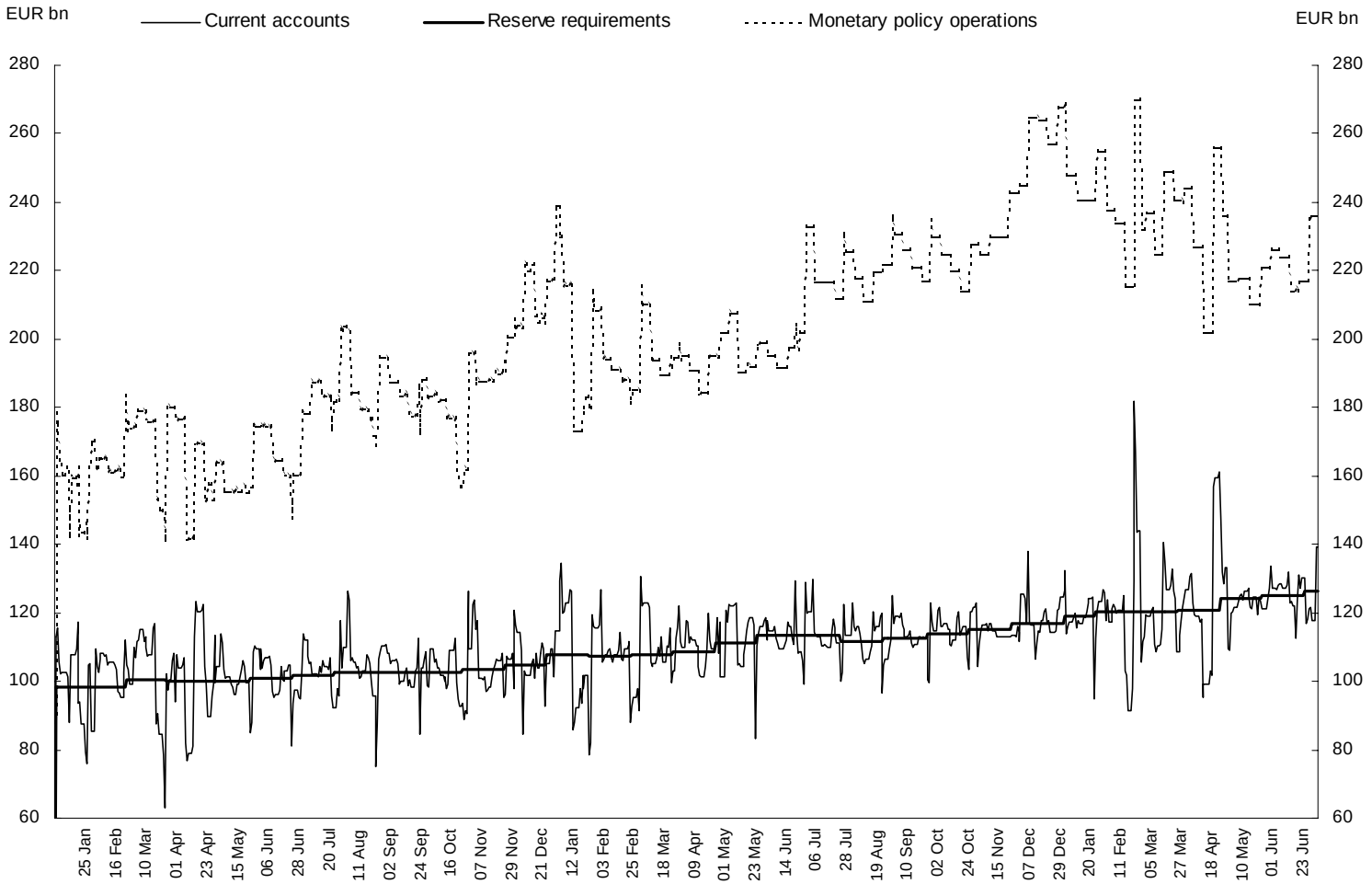
Federal Reserve - banking system liquidity (2000)



Federal Reserve - current accounts and required reserves (2000)



Eurosystem - banking system liquidity (2000)



The operational framework of the Eurosystem and financial markets

On 5 and 6 May 2000, the European Central Bank hosted a conference on "The operational framework of the Eurosystem and financial markets". The conference was organised by the ECB's Directorate General Operations and Directorate General Research. Its purpose was to provide a forum for a thorough discussion of the Eurosystem's operational framework for monetary policy and of its interaction with financial markets. It involved the ECB, the Eurosystem's national central banks and other central banks, the Eurosystem's counterparties in operations, researchers from academia and international organisations. The papers presented can be downloaded from the ECB web page (www.ecb.int).

Conference programme

Welcoming address:

Sirkka Hämäläinen (Executive Board, European Central Bank)
"The operational framework of the Eurosystem"

Presentation and general perspective of the Eurosystem's operational framework

M Manna, H Pill and G Quirós (European Central Bank):
"The Eurosystem's operational framework in the context of its monetary policy strategy"

U Bindseil (European Central Bank):
"Central bank liquidity management: theory and euro area practice"

Panel discussion:

T Baliño (International Monetary Fund)

X Freixas (Pompeu Fabra University)

C Goodhart (Bank of England and London School of Economics)

Collateral and infrastructural aspects of the Eurosystem's operational framework

O Mastroeni (European Central Bank):
"The collateral framework of the Eurosystem: some evidence in the first months of the European Monetary Union"

I R Terol and D Russo (European Central Bank):
"The euro area securities clearing and settlement infrastructure: recent changes and issues for debate"

Panel discussion:

D Humphrey (Florida State University)

J Mérère (SICOVAM)

P Twilhaar (ABN AMRO Bank)

A comparison between operational frameworks

P Fisher (Federal Reserve Bank of New York):
"A comparison between three operational frameworks: the Eurosystem, the Fed and the Bank of Japan"

(Background paper "Main features of the monetary policy frameworks of the Bank of Japan, the Federal Reserve and the Eurosystem")

C Borio (Bank for International Settlements):
"A critical perspective on the existing operational frameworks"

Panel discussion:

D Gros (CEPS)

I Kuroda (Bank of Japan)

D Blenck (European Central Bank)

The performance of the Eurosystem's operational framework since the introduction of the euro: an appraisal

P Vergara (Rabobank):
"The performance of the Eurosystem's operational framework: a market appraisal"

Gabriel Perez Quirós (European Central Bank) and *Hugo Rodriguez* (Pompeu Fabra University):
"The daily market for funds in Europe: has something changed with the EMU?"

Panel discussion:

J L Escrivá (European Central Bank)

A Steppan (Bankaustria-Credit Anstalt)

T Välimäki (Bank of Finland)

Dinner address:

V Gaspar (European Central Bank):
"Financial markets and the monetary policy strategy of the ECB"

The integration of euro money markets

B Biais (Toulouse University), *P Hartmann* and *M Manna* (European Central Bank):
"The microstructure of the euro money market"

M Ciampolini (Banca Commerciale Italiana) and *B Rohde* (Dresdner Bank):
"Money market integration: a market perspective"

Panel discussion:

J Alonso (Bank of Spain)

E Pauly (Bank of France)

K Tsatsaronis (Bank for International Settlements)

G de Vidts (European Repo Council)

Developments in the euro bond markets

G Bishop (Adviser to Salomon Smith Barney):
"The euro bond market: developments and implications for monetary policy"

Panel discussion:

L Boman (European Commission)

J C Corrigan (Irish National Treasury Management Agency)

C Monticelli (Deutsche Bank)

L van Velden (the Netherlands Bank)