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MONETARY POLICY OPERATING PROCEDURES IN THE UNITED STATES, JAPAN AND EMU: A COMPARATIVE ASSESSMENT

by C E V Borio
Bank for International Settlements
Tel: +41 61 280 8436
Fax: +41 61 280 9100
E-mail: claudio.borio@bis.org

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A comparative assessment

Introduction

I have been kindly invited to provide a "critical" comparative analysis of the monetary policy operating frameworks in the United States, Japan and European Monetary Union (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 hundred ways to skin a cat, so there are hundred of ways of implementing 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.[1] 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[2]

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 level of the pursuit of the policy goals of the monetary authorities.

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.

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 magnitudes. This subsumes issues such as the choice of

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[1] This section could be shifted by those already familiar with the field.

[2] This section draws heavily on Borio, "The implementation of monetary policy in industrial countries: a survey", BIS Economic Papers No. 47, July 1997.

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 indices 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 pertain to 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 (e.g. those on standing facilities), market operations (e.g. 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.*[3] 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.[4]

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.[5] 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 the

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

[4] 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 through 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.

[5] This is an adaptation of the framework illustrated in Kneeshaw and Van den Bergh (1989).

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.[6] Indeed, where, as is often the case, the settlement system provides for a period for 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).[7] 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 an *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, i.e., that amount is a bye-gone.[8] As a result, the factor influencing the 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

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[6] 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 is the case in the Netherlands.

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

[8] 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.

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.[9]

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.[10] 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).[11] 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).[12,13]

These arguments suggest that, ceteris paribus, reserve requirements with averaging provisions call for a *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).[14] If anything, this makes signalling even more important as a mechanism for limiting volatility in that rate.

The supply of bank reserves

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[9] 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.

[10] 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.

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

[12] On the last day the amount demanded would be equal to whatever amount is 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 be immediately lost.

[13] 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.

[14] 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.

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*"),[15] 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 those arising from valuation effects; see Box 1); and reductions in currency in circulation ("cash").[16] An *autonomous* surplus (deficit) can be said to exist if autonomous factors lead to a net increase in (withdrawal of) liquidity.[17]

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 (Section IV). If the supply falls short of the 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 spend 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 no 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 equally meet net liquidity surpluses and shortages. 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 the 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).[18]

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

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

[17] 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.

[18] The distinction between the two need not map one-to-one into the type of instrument used. Reversed transactions such as repos, a typically discretionary instrument, may be offered on a standing basis, or discretion may be used in granting

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 infra-marginal 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 providing the bulk of liquidity needs; their timing and, sometimes, maturity are closely tied to the characteristics of the maintenance period.[19] 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 (Section V). 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.

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 (e.g., 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*.[20] 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.

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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.

[19] Not all regular operations are used for this purpose (Section IV).

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

II. Assessing the operating frameworks

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.

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 therefore is also the market rate acting as operating target (more precisely, the federal funds rate[21] 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 operation (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 EMU. 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 valuable particularly 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 rate to be very close. This has indeed been the structure in the EMU set up.[22] 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 with respect to one important aspect, viz. 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 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-keyed

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

[22] 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).

quantity signals through market operations and higher-profile price signals through the discount rate.[23] 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[24]. 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 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 deposit facility) form a corridor that sets a maximum and minimum to the overnight rate, given that the maturity of the operations is overnight. In the United States and Japan, no facilities available on demand are present, and none exists to deposit funds with the central bank at positive rates.[25] In the United States, following the deactivation of the temporary special lending facilities introduced to cope with Y2K, 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 seventies. The large width of the corridor set in the Eurosystem is a clear illustration: the overnight rate remains well within the bounds. Likewise, at present these facilities have 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.[26]

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 Fed[27] and Bank of Japan and the

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

[24] The arrangements have been conceived with the possibility of operating either through fixed or variable rate tenders.

[25] 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.

[26] 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.

[27] 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

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 inter-bank transactions. The other side of the coin is that the central bank has to make sure that it does 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.[28] 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.[29] 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 by far highest in Japan, with those in the United States and the Eurosystem being of a similar order of magnitude. If measured in relation to the

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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. In addition, the balances count as a deficiency in the calculation of the fulfilment of reserve requirements.

[28] The central bank used this facility as an active tool of liquidity management until mid-1995, deciding at its own discretion amounts and maturities 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.

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

size of the reserve requirement, however, volatility in the United States[30] 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 sizable in Japan. Measured in relation to the reserve requirement, forecast errors tend to be largest in the United States and lowest in the Eurosystem.

Turning to individual autonomous factors, there are certain considerable similarities across countries. In all three systems currency is among the most volatile items, but also one with rather predictable seasonal patterns. [31] 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 re-depositing of end-of-day balances with banks (Germany)[32]. A more radical measure is not to supply deposit accounts to the Government (e.g., 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 necessary 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 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.[33] 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 were fulfilled with cash. Finally, the averaging period is shorter, viz. 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

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[30] 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 in even higher in the United States.

[31] In the EMU, 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.

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

[33] 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.

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, stepped-up 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 (MMDAs). 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.[34] 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 characteristics of the reserve requirements in the United States retain features consistent with the a more quantity-oriented approach to monetary policy implementation, in which the reserve requirements are used as a means of controlling monetary aggregates, or 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[35] [36].

Probably the change in the characteristics of the requirements that would be most effective in improving their effectiveness as a buffer would be to increase their level. This, however, would run against the longer run international policy trend, which has been to reduce the requirements in response to domestic 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.[37] 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 of reserves in an effort to reduce the cost of holding reserves,

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[34] 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.

[35] 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.

[36] 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.

[37] 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.

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 expect, 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.[38] 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 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 set up 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 so as to cope equally with deficit 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 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, e.g. 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 the 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.

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[38] 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.

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 mirror largely 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 (e.g., 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 markets 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 form of transaction takes the form of repurchase agreements. Repurchase transactions such as repos[39] are generally preferred to outright open market operations for several reasons: they do not require a liquid underlying market for securities;[40] 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, have 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 that for private repos. This is true, for instance, of the repos used by the Eurosystem. [41]

The spectrum of eligible *collateral* is considerably broader in the Eurosystem 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 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[42]. Thus, for instance, several countries broadened the range of available collateral in the run up to the Y2K century change-over. Some of this, 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 perspective decline in the stocks of government debt in some countries, such as the United States, could induce a reconsideration of

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[39] 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.

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

[41] 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.

[42] 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.

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 differ significantly also 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.[43] Japan falls somewhere in between, with counterparties varying depending on the type of transaction, but with a common requirement that the institution should 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 a broad 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 also in the Eurosystem the set of counterparties is restricted in order to secure rapid and smooth execution.

Conclusions

The frameworks of monetary policy operating procedures in the United States, Japan and EMU share some fundamental characteristics. The central banks steer closely very short-term interest rates 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 trough repurchase agreements. In these respects, the frameworks resemble closely 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.

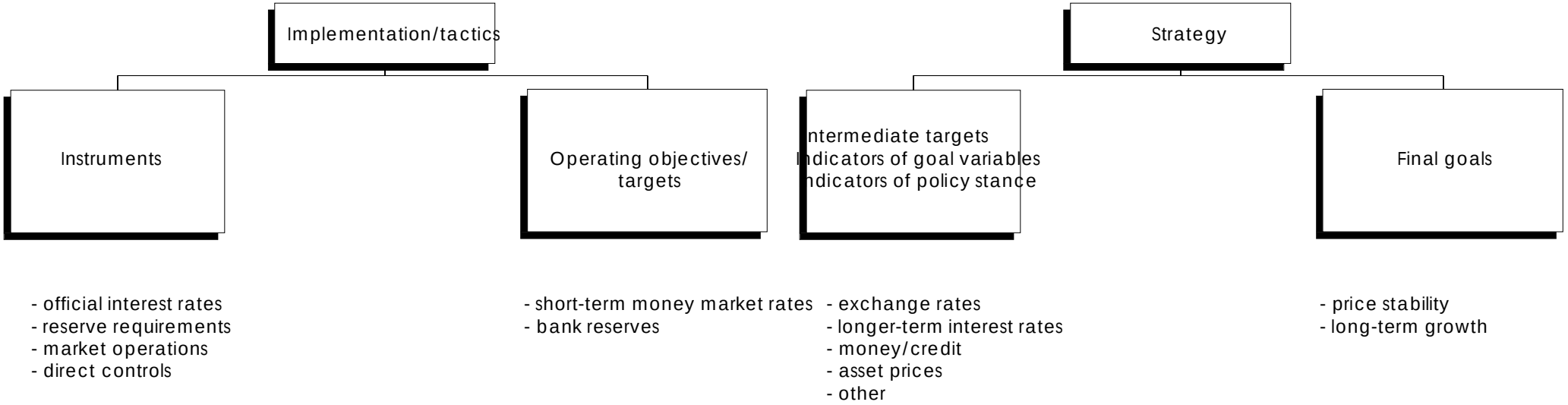
At the same time, certain differences can also be discerned with respect to signalling mechanisms and liquidity management procedures. The key signals of the Federal Reserve and the Bank of Japan are announcements of target rates for the overnight rate; the Eurosystem signals the desired level of short-term 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.

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

[43] Eligibility of counterparties for standing facilities in the United States and EMU are essentially based on the institutional criteria. In EMU, the set coincides with that for regular tenders, although the operational criteria are somewhat different.

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.

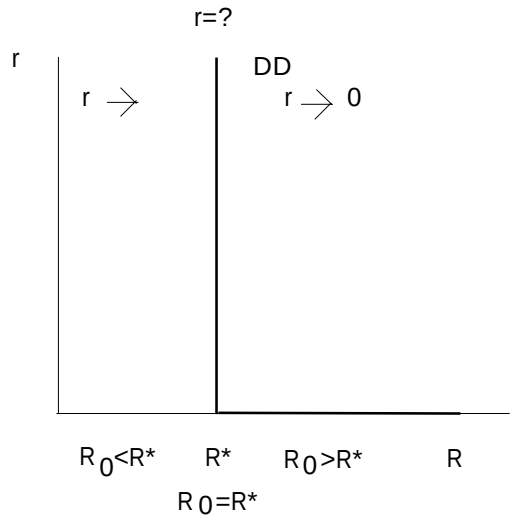
Graph I: The monetary policy framework



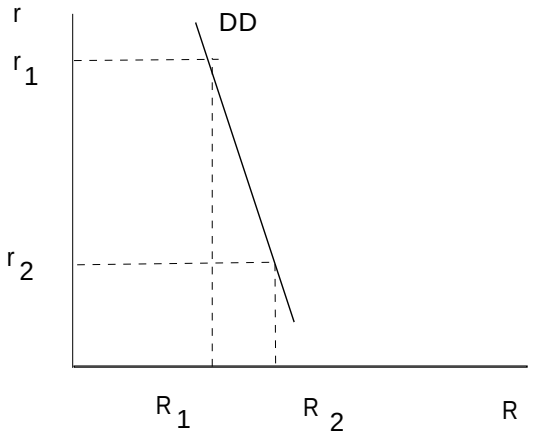
Graph 2

The demand for working balances

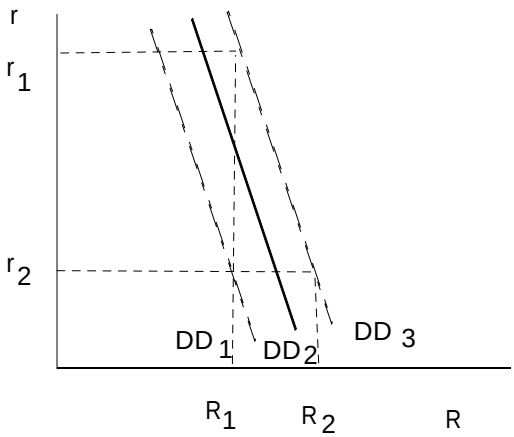
Panel A: No interest rate sensitivity



Panel B: Small interest rate sensitivity



Panel C: Instability



Comments:

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

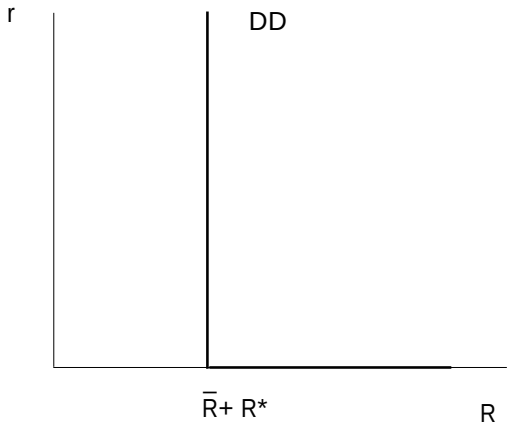
Panel B: Small changes in the supply of bank reserves (R_1 to R_2) result in large changes in the interest rate (r_2 to r_1).

Panel C: Given a low interest rate sensitivity, instability (DD_1 to DD_2) 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.

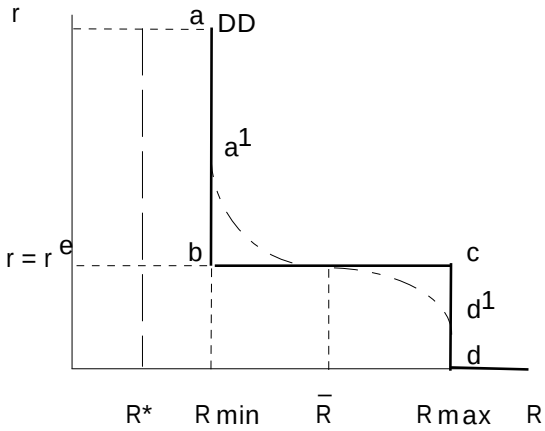
Role of signalling: In case A, signalling can help to focus expectations on a particular interest rate within the range of indeterminateness.

Graph 3
The demand for bank reserves under reserve requirements

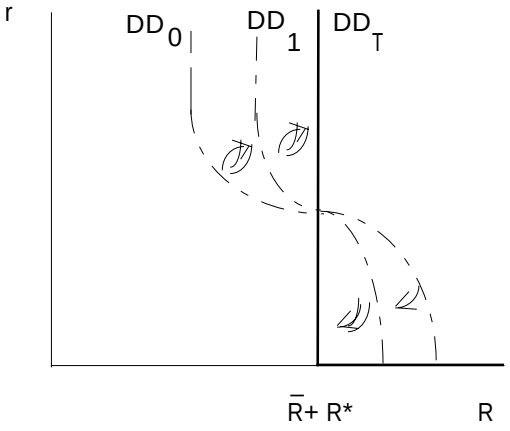
Panel A: End of maintenance period



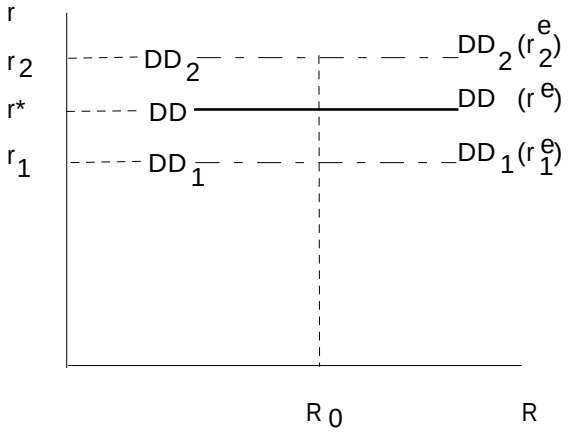
Panel B: Beginning of maintenance period extreme case



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 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).

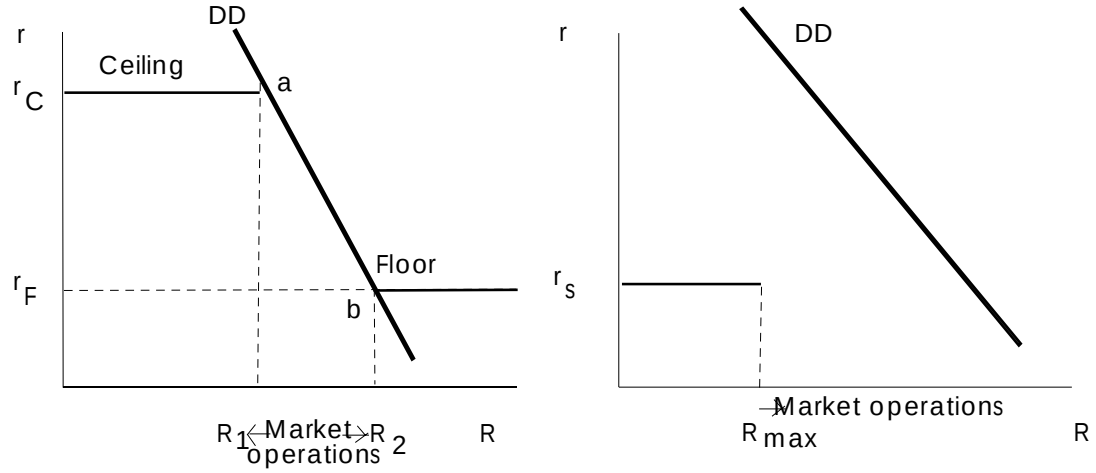
Panel C: Over time, the demand for reserves converges to that ruling at the end of the maintenance period (DD_0 to DD_T).

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 (e.g. r* in Panel D).

Graph 4

The supply of bank reserves



Panel A: The standing facility at r_C sets a ceiling to 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.

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.

Annex I provides a description of changes in national central bank balance sheets along these lines.

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 (i.e. making up "net lending to banks" or the "net policy position") can be broken down according to several criteria: by 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 include also the corresponding discounting of securities.

2. *Reversed 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. *Reversed 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. *Issue of short-term paper*: sale of central bank paper in the primary market. Defined also to include issues by the central bank of government paper on its behalf performing a similar function.

6. *Operations in the interbank market*: interventions 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.*

In terms of ***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 complementary 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 (see Section IV).

* 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.

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					Billion US$
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.