Centre for Central Banking Studies

Monetary operations

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MONETARY OPERATIONS

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Foreword

The series of *Handbooks in Central Banking* and the accompanying *Lecture* series form a key part of the activities of the Centre for Central Banking Studies (CCBS) at the Bank of England. The CCBS has been in existence since 1990, delivering seminars, workshops and expert advice to central banks all over the world. The *Handbooks* and *Lectures* cover the same subject matter; namely the technical and analytical aspects of central banking.

The *Handbooks* and *Lectures* are aimed primarily at central bankers, and have proved an extremely popular and useful reference works for all those looking for materials that provide both a clear analytical framework together with the practical application of these ideas.

Most of the CCBS *Handbooks* and *Lectures* are also available from our website www.bankofengland.co.uk/education/ccbs/handbooks_lectures.htm. Several have been translated into Spanish, Russian and Arabic, and these versions are also available on the website.

Our aim is to continue to add to the series, covering new areas of interest and also updating existing *Handbooks* to take account of recent developments. Some of the latest *Handbooks* will include econometric exercises developed in our workshops, thus making these available to a wider audience.

We hope you find the new additions to the series useful, and would welcome any comments on the *Handbooks* and *Lectures* and any suggestions for future topics.

We should note that all views expressed are those of the authors and not necessarily those of the Bank of England or Monetary Policy Committee members.

Andrew Blake and Gill Hammond
Series Editors

MONETARY OPERATIONS

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ABSTRACT

Monetary operations refer to the implementation of monetary policy – ensuring that the policy decision has the intended impact on financial markets, and on the economy more generally. Under this broad umbrella, the monetary authorities need to decide which specific targets to aim at, and which policy instruments should be used. For most countries the final long-term monetary target of the central bank is low and stable inflation. For operational purposes, however, the day-to-day tactical target is usually to achieve a particular level of interest rates or the exchange rate.

In market economies it is widely held that in the long run the most efficient instruments of monetary policy (the operational levers) are those which best complement the workings of a market system. This is why indirect market-based instruments – using the central bank's balance sheet - are preferred to direct (administrative) controls. The latter may work for a while, but tend to distort markets and are open to evasion. This handbook examines the various different indirect instruments: (i) open market operations (OMOs); (ii) standing facilities (SFs); and (iii) both required reserve (RRs, which have some of the characteristics of direct controls) and voluntary or contractual reserves. Open market operations are undertaken at the initiative of the central bank whereas standing facilities are used at the initiative of the commercial banks. Participation in both is voluntary at the level of individual banks, whereas in most countries reserve requirements are an administrative imposition on all banks - albeit one which, through averaging, allows them a degree of day-to-day flexibility.

Monetary instruments are not only used to implement monetary policy; they are also used for liquidity management. This is an essential part of the central bank's operations, in order to prevent the short-term uncertainty and price volatility which day-to-day swings in market liquidity would otherwise cause.

A certain amount of detail is given about current practice in countries, not to be prescriptive but to give some impression of the varying balance of instruments in the monetary policy framework of different countries. Since monetary operations are continuously evolving, some of the detail described herein as current practice may become out of date, but the general principles and analysis remain valid.

MONETARY OPERATIONS

1 INTRODUCTION

The main goal of monetary policy for most central banks is to achieve price stability through the maintenance of the internal or external value of the domestic currency. In the domestic economy this means to keep inflation low and steady; externally, it normally means targeting the nominal exchange rate[1]. Setting an explicit inflation target as the final goal of monetary policy has become increasingly popular over recent years. By contrast, over the last decade many central banks have moved away from formal pegs or tightly-managed exchange rates[2].

In practice, for many smaller open economies the policy choice between a domestic or external target is not clear cut. Where there is a rapid pass-through from exchange rate movements to domestic inflation, or where central bank credibility is not sufficiently strong, policy may in practice attempt to straddle both a domestic and an external target.

In order to set the appropriate conditions for achieving the high-level goal, central banks sometimes use an intermediate target such as elements of the central bank's balance sheet, or a broad monetary aggregate or the exchange rate, to act as a nominal and easily visible anchor. In an inflation-targeting regime, some view the central bank's inflation forecast as a form of intermediate target: a forecast out of line with the inflation target itself would prompt a policy reaction. Since most intermediate targets are outside the direct control of the central bank, it usually chooses a separate tactical target, which it can more directly control - typically a short-term interest rate or the exchange rate - which will influence the medium-term development of the intermediate target. In any case, in order to influence the markets, the central bank will use operational levers – financial transactions with the market - which involve using its balance sheet.

For example in the U.K. the Bank of England's Monetary Policy Committee (MPC)[3] sets a short-term interest rate for the Bank's transactions with the market (the operational lever), and the Bank's operational framework is designed to ensure that market interest rates at maturities out to the next MPC

[1] Some countries target the real exchange rate: this will tend to stabilise competitiveness at the expense of more price volatility.

[2] Calvo and Reinhart (November 2000): "*Fear of Floating",* National Bureau of Economic Research Working Paper 7993; http://www.nber.org/papers/w7993), shows that the percentage of IMF member countries with a pegged exchange rate dropped from 33% in 1985 to 11% in 1999, while those with fully flexible rates (at least notionally) rose from 25% to 45%. In practice, many central banks manage their exchange rate even if it if formally free-floating.

[3] Formed in 1997 when the Chancellor (Minister of Finance) announced that the Bank of England would have operational independence for setting interest rates.

meeting are consistent with this rate. The Bank has estimated that there is around a two-year lag before interest rate changes have a full effect upon inflation and therefore the Monetary Policy Committee will look, inter alia, at the 2 year inflation forecast[4] (the intermediate target) in deciding whether to adjust interest rates in order to achieve the Government-set inflation goal – currently, Consumer Price Index inflation of 2.0% year on year.

If the high-level goal is the exchange rate, a central bank may be able to influence it directly by operating in the foreign exchange markets, although it could also use the interest rate channel to influence the exchange rate.

Understanding the central bank's balance sheet is essential in considering monetary operations. The central bank is, by definition, the only (legal) supplier of reserve money – cash and commercial banks' balances - and so it has, even in a liberalised financial system, a dominant influence over monetary conditions[5]. Where the central bank's balance sheet is liability-driven, and demand for central bank money is the dominant driver of balance sheet size, the commercial banks will typically have to borrow from the central bank. This lending provides a strong operational lever, since demand for central bank money – prior to the central bank's operations – exceeds supply. But central bank influence may be weaker where its balance sheet is asset-driven and there is consequently an excess supply of reserve money: banks' 'free reserves' – before central bank operations - exceed working or voluntary balances. This might reflect a legacy of monetary financing; or an exchange-rate or foreign reserves target, or other actions resulting in a net accumulation of foreign exchange reserves by the central bank; or lender of last resort activities. In these circumstances, the marginal demand for central bank money might be zero or negative. The central bank can still exert influence over monetary conditions by acting as the marginal taker of central bank money, but in this case relies on its ability to pay, rather than on a legal monopoly over supply. In practice, the central bank's freedom is often constrained in such circumstances by a concern that it may run a loss.

The instruments used to impose monetary policy are the same as used to manage liquidity in the market. Even if it did not want to guide the price of money (whether internal or external), it is almost universally the case that central banks seek to reduce the short-term volatility in prices which can arise from fluctuations in liquidity. These fluctuations might arise from timing differences between government revenue and expenditure; or between government expenditure financed by foreign exchange revenue, and the economy's demand for foreign exchange. Without central bank intervention to offset these

[4] Although the inflation forecast is now published out to a third year, having been extended mechanically.
[5] An exception is in so-called "dollarised" economies where foreign currency is used as a substitute for domestic cash as a means of payment and as a store of value. In this case the domestic central bank will have limited control over inflation (in "dollar" terms) or economic activity in its economy.

liquidity fluctuations, short-term interest rates and/or the exchange rate will be more volatile than necessary; and this tends to disrupt financial sector development as well as potentially obscuring the central bank's monetary policy. Liquidity management is therefore an essential part of efficient monetary operations by any central bank.

This handbook does not go into detail on monetary policy frameworks (the transmission mechanism, including the choice of intermediate and high-level goals of monetary policy[6]), but will concentrate on the operational framework and the monetary policy instruments (the operational levers) within that.

[6] See *Handbook No 1* "Introduction to monetary policy" and *Handbook No 2* "The choice of exchange rate regime".

2 INTERACTION BETWEEN TARGETS AND LEVERS

i: Domestically-framed monetary policy

When choosing an operational lever, the central bank has to take account of the effectiveness and reliability of using that lever in hitting the policy target; the scope for and cost of using the lever in a given situation; and the impact on the financial markets and the economy more generally. For countries that choose to have a domestic (independent) monetary policy - and by implication accept a floating exchange rate - there is little choice in day-to-day operations but to target a short-term interest rate and support interest rate stabilisation, and indeed this is what most central banks choose to do. This interest rate – the Policy Rate – is normally that used for Open Market Operations (OMO).

The day to day path of reserve money demand will tend to be quite volatile, in part because of strong within-week, within-month and month-to-month seasonality in demand for cash, and in part because of the lumpy movement of some autonomous factors e.g. government monthly salary payments. These will be more important factors in a cash-based economy e.g. where savings are held in cash. The short-run demand curve for reserve money tends to be interest-rate inelastic: central banks do not expect a rate-change today to affect demand for notes tomorrow; and if bank reserves are remunerated, their cost is not affected by changes in official interest rates.

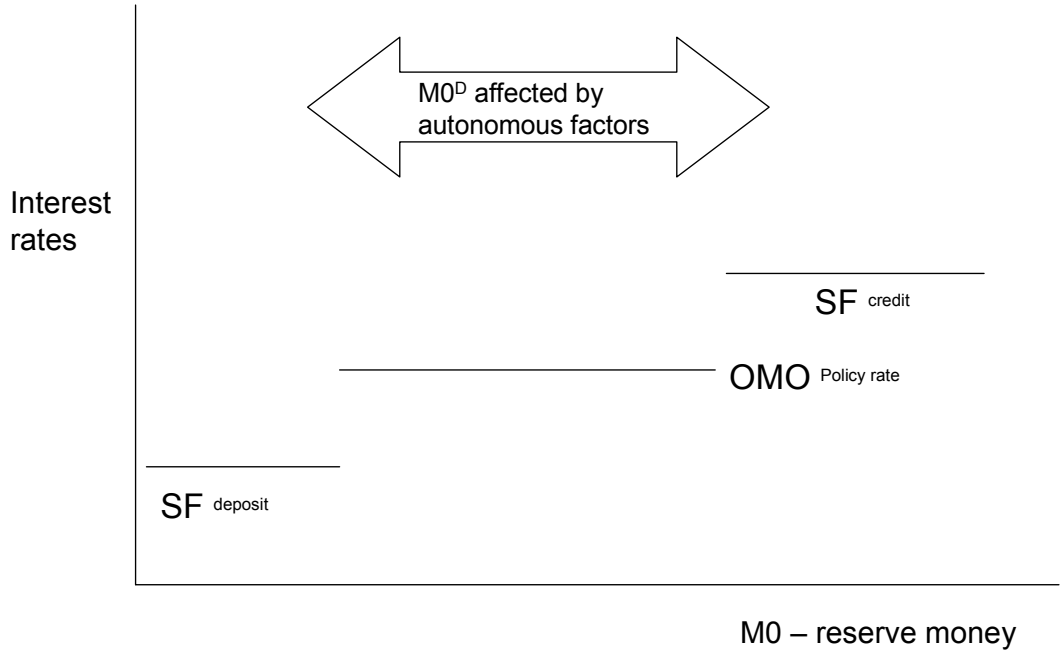
To the extent there is an opportunity cost to holding precautionary reserves (reserves which may or may not be excess, reflecting uncertainty in liquidity management), banks may be prepared to hold more if the opportunity cost falls – for instance, if the opportunity cost of holding the reserves falls, it may be cheaper to hold additional reserves than risk occasional borrowing from the credit SF. Ideally this should be, and in most developed markets is, a very small factor. For practical purposes in most countries, the short-run demand curve may be characterised as vertical in respect of interest rates (but it will still be affected by non-interest rate factors), while the short-run supply curve is normally horizontal: central banks tend to be accommodative in meeting the demand for high-powered money in the short-run - for instance, notes are normally supplied on demand. Even central banks with a monetary aggregate target will tend to supply or absorb liquidity as necessary on a day-by-day basis. They target short-term interest rate stability in the *short run*[7] since they regard the uncertainty caused by short-term volatility in interest rates as more harmful to the economy than short-term volatility in the quantity of reserve money.

[7] Many countries have a narrow target *range* for interest rates which they attempt to maintain through a combination of open market operations and standing facilities.

There may be clear structural reasons for using interest rate levers: for instance, in the U.K. there is a high level of home ownership, and many owners fund their purchase with a variable-rate loan. Changing short-term interest rates can therefore have a very immediate impact on the cash flow of a large part of the population. There will also be more general reasons, such as the impact on investment borrowing – though in some economies the government is the chief borrower, while entrepreneurs may borrow informally, from friends and family, and this will tend to weaken the interest-rate transmission channel. A central bank might also prefer the interest-rate channel if there is no reliable short to medium-term relationship between monetary aggregates and inflation - for instance, if the financial sector is undergoing substantial structural change such as de-dollarisation, or technical improvements to non-cash payment systems which alter the structure of money demand.

Central banks can take advantage of the short-run vertical slope of the reserve-money demand curve to change official – and thus market – interest rates, without the need for a change in the volume of reserve money. For any given level of demand for central bank money, the central bank will normally aim to supply (or drain) at the OMO/policy rate; and a change in the OMO rate will not have an immediate impact on the level of demand[8].

Changes in demand for M0 do not need to impact on interest rates providing central bank operations are accommodative



[8] Unless free reserves are remunerated at a variable spread to the policy rate, so that a rate change affects the opportunity cost to banks of holding precautionary central bank balances.

The chart above illustrates that if OMOs do not accurately offset the impact of autonomous factors – whether because the liquidity forecast is inaccurate, or because the central bank does not aim fully to offset the shortage or surplus; and money demand moves to the left or the right of the horizontal OMO line – then the marginal interest rate at which banks transact with the central bank will change to the appropriate SF rates, with a consequent impact on market rates.

In the somewhat longer term – over a period of several months or longer – the central bank may be able to target the size of its balance sheet (volume of reserve money), allowing the price (interest rates if internally-framed policy, the exchange rate if externally-framed) to vary in order to influence demand for cash; though it will be more common for a central bank to target a wider money aggregate, including commercial bank lending, than a narrow one. Indeed, where inflation and consequently market interest rates are high and volatile, it may be difficult for the central bank to set an intervention rate which does not quickly appear to be out of line with the market. The same may be true in a transition phase where the level of inflation is falling rapidly (eg Mexico in 1995-96). Countries with IMF financial programmes may have medium-term quantity targets for central bank assets or liabilities[9]. In these circumstances, the medium-term target may be the quantity of reserve money or central bank credit (see Appendix 1). But such targets cannot normally be met on a day-to-day, or week-by-week, basis, and the central bank may well still use an interest rate lever to achieve such an objective, raising rates to discourage lending growth etc. In any case, it would be very difficult to set a daily path for reserve money that was accurate enough not to generate volatility in interest rates and the exchange rate, so that in the short to medium term central banks will normally allow the reserve path to adjust.

As indicated earlier, whether or not a central bank uses an intermediate monetary aggregate target, its operational levers will almost always be exchange-rate or interest-rate based; and while the choice of such an intermediate target may affect the way in which operational levers are used, it does not necessarily affect the choice of levers themselves.

(a) Maturity of interest rate operations

In developed markets where the central bank's tactical target is the short-term market interest rate, it usually seeks to use as a lever the very short end of the yield curve - from overnight up to, perhaps, two

[9] In extreme circumstances, for instance where a central bank has been forced to abandon a pegged exchange rate, some central banks have adopted a base money target as an interim measure. It may be a crude target, but in volatile conditions where the recently-used nominal anchor has had to be abandoned, it can be useful in helping to re-stabilise the markets. And such targets are – at least prima facie – easy to understand and communicate, aiding credibility.

weeks. In this case, the central bank provides the net liquidity requirement to the banking sector for up to two weeks at its chosen intervention rate. In a number of countries – notably the UK and in the euro area – the intention is to steer the market yield curve until the end of the current maintenance period, which coincides with the regular Monetary Policy Committee/Governing Council meetings. Provided (i) there is no expectation of an official rate change before the end of the maintenance period and (ii) the central bank manages liquidity efficiently, then market rates to the end of the maintenance period should accurately reflect the official rate.

This inevitably *affects* the yield curve for longer maturities, but does not *determine* it. The longer end of the yield curve – which may be represented by secondary-market yields on government securities - is normally determined by the financial markets. Longer-term yields should, broadly, be a function of expected future short-term interest rates (themselves a function of expected inflation and the real interest rate) and a time-varying risk premium. If the market judges that the central bank will need to raise its policy rate in the future as a response to rising inflation, or a weakening of the exchange rate, the yield curve will have a positive (upwards) slope. But if the central bank's monetary policy (and probably the government's fiscal stance, and balance of payments prospects) are credible, the yield curve may be relatively flat.

In some transitional economies, open market outright purchases and sales of government securities of all maturities are an important liquidity management/monetary policy tool; but are also used for management of the government debt market. At times there may be conflicts of interest as the same instrument serves different purposes. If the central bank regularly intervenes at longer maturities as a price setter, then the yield curve will no longer be market-determined, and market arbitrage will not operate well. In developed markets, if the central bank operates at maturities much beyond a few weeks, it does so typically as a price taker. This is the case with the US Federal Reserve Bank's 'coupon passes' (purchases of long-term bonds). The Bank of England is considering a similar approach with the introduction of the new operational system from 2006, when the prospective increase in the size of the Bank's lending operations might support moving some of the liquidity provision onto a longer maturity (see Appendix 3 on size of operations).

If a central bank operates at more than one maturity, and uses different interest rates for those maturities – a number of central banks do this - it should consider carefully the implications of its rate structure. For instance, if it is accepted that forward rates are a combination of the real interest rate and expected future inflation; and if in addition it is assumed that the real interest rate will be stable in the short term, then

using a higher interest rate for longer-term operations might imply that the central bank expects inflation to rise. If this is not the intended signal, then what does the rate differential mean?[10]

The central bank could have different bases for different types of intervention, for example, a market-based rate for open market operations and an independently-set rate for standing facilities – setting broad limits to interest-rate volatility without over-constraining the day to day market rate. But this need not affect the maturity of operations. Or it could use a policy rate for short-term operations and a market-determined rate for longer term operations (so that the longer-term rate carries no monetary policy signal: the Bank of England and the ECB are examples of this approach).

(b) Relationship between the operational lever and the tactical target

It is also important to consider the interaction of the central bank's official rates and market rates. Theory might suggest that if the central bank wants to fix a short-term interest rate, then it should lend/withdraw as much liquidity as the market demands at that rate, so that the volume of its transactions would be potentially unlimited. In practice they are, of course, limited. If the market counterparties requested substantially more or less than the market as a whole needed, and the central bank simply accommodated that, market interest rates would not long stay at the targeted level unless the central bank operated in both directions at the same interest rate[11]. The market is not monolithic, and no individual participant knows what the overall need is. Central banks will, therefore, attempt to forecast the market need and operate in such a way as to meet that need. OMO operations are thus not unlimited[12]. Similarly, use of the deposit SF cannot be unlimited, since it is constrained by the commercial banks' holdings of central bank money. SF transactions are likely to be relatively small in relation to the size of the OMO where (i) the central bank's liquidity forecast is good enough for OMO to be used effectively for liquidity management and (ii) the structure of operations and rates both allows and gives an incentive to the market to participate actively in OMO. Credit SF are also constrained, by the commercial banks' holdings of securities eligible for use in credit SF operations. In some countries this will be relatively small; but provided it is larger than the expected need, the constraint is not binding.

It is clear that the banks will be influenced by the rate at which they borrow from/deposit with the central bank. The actual rate applied to the commercial banks' transactions with the central bank will be the maturity- and volume-weighted average of their transactions using the different rates – OMO and

[10] It may be justified as a liquidity premium.
[11] This does in fact happen in small number of cases; but the central bank is likely then to replace the market.
[12] In general, potentially infinite transactions with the banks – whether OMO or SF – would imply infinite change in another, offsetting element of the central bank's balance sheet. This is clearly far from realistic.

the SFs. Market rates will be affected by the *expected rate* applied to those transactions over a particular period, and the *expected probability of use* of the OMO and SF in that period. The central bank will normally want its policy and operations to be as transparent as possible, so that the gap between 'actual' and 'expected' is both stable and minimal. In particular, most central banks will aim to structure and operate their routine transactions with the market such that the market expects to transact in the necessary volumes at the policy rate, and in normal circumstances have only negligible recourse to the standing facilities. The short-term market rate resulting from central bank operations might be expected to be:

Equation 1:

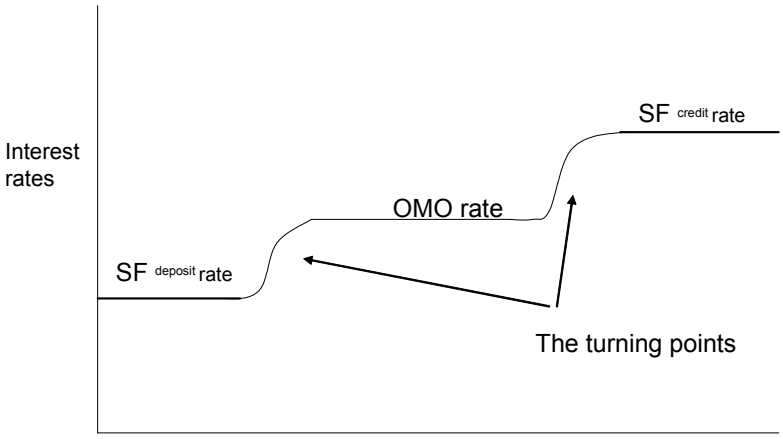
Short-term market rate = *fn* (OMO% * Pr.OMO, SF_d% * Pr.SF_d, SF_c% * Pr.SF_c)

- Pr. represents the *expected* probability of using a given instrument, weighted by the value transacted and the number of days in the maintenance period, and all the probabilities sum to 1;
- OMO% = policy rate and SF_d%, SF_c% the relevant SF interest rates;
- if there are additional SFs, or multiple OMO, they can be added to the list.

If there is no remunerated deposit facility, then SF_d% = 0; or one could add in to the equation "0%*Pr.Unremunerated excess reserves".

The short-term market rate may not exactly equal the weighted-average of expected rates. If from day to day the market is very uncertain which of the transactions will predominate, then market rates are likely to swing between the relevant rates. But if there is an expectation that OMO will deal with only half the volume of transactions required by the market, then the market rate is almost certain to move much closer to the relevant SF rate. As market sentiment shifts from an expectation that use of SFs will be very small to an expectation that it may be significant, short-term market rates may move sharply.

Non-linear move from OMO rate to SF rates



How far rates move towards the relevant SF rate will be a function of the expected size of SF use, and the degree of market certainty about its expectations. Longer-term rates will likely not move as sharply.

In a number of markets where there is a surplus of liquidity, the central bank does not aim to drain all surplus liquidity in its OMO – essentially because of the cost of so doing – leaving sizeable balances to be placed in deposit SF, or earning no return. Market interest rates will then reflect the expectation of substantial use of the deposit SF, with short-term rates falling below the 'policy' rate. For instance, if a central bank is expected to drain only half the market surplus at 6%, and pay 1% on a standing deposit facility, overnight market rates would probably drop to around 1%, rather than hovering around 3.5%. The SF_d would be the rate which guided the market: the cost of operations may thus constrain liquidity management, with consequences for policy implementation.

The turning point may come well before the half-way point. In the euro area, around 99.9% of commercial banks' transactions with the ESCB, weighted by maturity and value, are OMO at (or close to) the policy rate; and the market rate through most of the maintenance period is very close to this. But on days (the last day or two of the maintenance period) when the market expects to have to use SF, while actual SF use is rarely as much as 5% of outstanding borrowing from the ESCB that day, overnight rates tend to move more than half way to the SF rate. (On the last day of the maintenance period there may be no OMO, so Pr.OMO on that day will be equal to zero.) What is perhaps surprising is that the overnight rate does not move fully to the SF rate. A fourth factor might need to be included: the probability of not transacting with the central bank at all. We could add: "???% * $Pr._{\text{No transaction}}$" to equation 1. The use of ???% for $Pr._{\text{No transaction}}$" reflects the uncertainty as to what this interest rate might be: it will depend on market conditions and structure. But this underlines the importance of actual central bank transactions with the market in support of the central bank's policy. If over time the market did not expect to transact with the central bank at all or in any significant size, then the central bank's policy rates would have much less impact (Appendix 3 discusses the size of central bank operations). It may also be the case that if the marginal cost of borrowing from/depositing with the central bank is small, and especially if administratively it is easier and there is a perceived stigma to paying a high rate in the market, banks may at times prefer to access standing facilities rather than using the market. Market rates may not therefore move to the SF rates, even if banks have a strong expectation of having to use as SF.

This approach still holds if the central bank undertakes some of its intervention in the foreign exchange market, or in the domestic currency at long maturities using a market-determined rate. These transactions may make it easier for the central bank to provide/withdraw the appropriate amount of liquidity; but it is the domestic currency transactions at the central bank's official rates which will

determine short-term domestic currency interest rates. Where there is a foreign exchange target, and there are no substantial transactions at official interest rates (perhaps because there are none), the yield curve will reflect those of the targeted currency.

(c) Corridor Systems

Some countries minimise overnight interest-rate volatility by employing a very narrow corridor of standing facilities e.g. 50 basis points; this may be particularly helpful where there is no reserve averaging facility which banks could otherwise use to offset fluctuations in liquidity conditions. While mindful of not setting the width too narrow and intruding the central bank into normal market activity[13], they argue the narrow corridor can be used not just as a safety valve for market liquidity management, but also as a core instrument in guiding the structure of short-term interest rates. The central banks of Australia, Canada and New Zealand all take this approach. The Bank of England will adopt, in its money market reforms from H1 2006, a reserve averaging system (with voluntary rather than required reserves, held in agreed – contractual - amounts) together with a narrow interest rate corridor on the last day of the maintenance period.

This approach limits market interest rate volatility from overnight (the normal maturity of the SFs) out to the next interest rate policy meeting (potentially several weeks); but in fact these – and many other - central banks expect market rates to trade at a much narrower spread to the central bank policy (target) rate than the width of the corridor. This policy rate typically defines the centre of the corridor: the corridor is symmetric, the SF rates being set at the same margin above/below the policy rate. It is usually the rate applied to OMO tenders (the principle tool for providing liquidity to the market) in the case of a volume tender; or the rate which guides bids, in the case of a rate tender. Exactly where in the corridor the market interest rate will trade will depend in part on the probability of use of the OMO and the two SFs. If there is an equal probability of use of the SFs, then the average market rate should tend towards the centre of the corridor and hence the policy rate. The smaller the probability of using the SFs, the narrower the trading range of market rates should be[14]. At the limit, if there is a zero probability of either facility being used, the market rate should equal the OMO, or policy, rate[15].

[13] At the limit, if the SFs both carried the same rate – a zero width band – then commercial banks would deal with the central bank rather than each other at the SF maturity, and no market rate could exist.
[14] In Australia, for instance, little use is made of the SF credit facility, as voluntary reserves levels adjust from day to day, in much the same way as required reserves vary in reserve averaging systems.
[15] A further exposition on interest rate corridors can be found in Michael Woodford: "Financial Market Efficiency and the Effectiveness of Monetary Policy" (Princeton University, Department of Economics)

As well as helping to set the structure of short-term interest rates, the corridor provides automaticity, as the central bank stands ready to deal with its counterparties on demand at both the upper and lower rates. Hence there is no danger of any 'signal' being read into the availability of these facilities. Supporting this automaticity of standing facilities, the Reserve Bank of New Zealand[16] also argues that due to the imprecise relationship between the quantity of settlement cash provided and the resulting level of interest rates, choosing the appropriate structure and amount of operations to achieve a particular target – i.e. designing a pro-active volume-based OMO - may not be straightforward[17].

The central bank can set a policy rate but operate a rate tender, allowing some (normally small) fluctuation in the actual rate of the OMO. For example, the ECB sets a minimum rate for the OMO, with actual rates being 5-10 basis points higher; and the US Fed sets a target rate, with actual operations up to 5-10 basis points above or below the target. As long as the volume supplied in the OMO, and the flexibility provided by reserve averaging – if available – is sufficient to supply (absorb) a shortfall (surplus) in liquidity, then market overnight rates should be around the policy rate. The more accurate the central bank's operations, the tighter will be the spread around the policy rate. A central bank forecast of expected market demand is an important part of this process. But to the extent there is a market expectation that substantial use will need to be made of one or other of the SFs, then the market rate will tend towards the relevant SF rate; and it is likely to do so in a non-linear way, as suggested earlier[18]. As rates move towards the SF rates, market forces should tend to offset the move to the extent the market has scope to manage the liquidity change. For instance, if there is a shortage of liquidity and rates rise, the reward for lending will increase, and the risk of having to access the credit SF will be reduced (because the gap between market rates and the SF rate has reduced). This should encourage more banks to lend out any precautionary holdings of liquidity, and so bring rates back down.

(d) Monetary policy decisions and reserve maintenance periods

In-between meetings of the Bank of England's MPC, or the Federal Reserve Federal Open Market Committee (FOMC), or the relevant meetings of the ECB's Governing Council, there will be a virtually zero expectation of changes in the rate structure, and short-term rates up to the next meeting should

[16] The Reserve Bank of New Zealand (David Archer, Andy Brookes and Michael Reddell): "A Cash Rate System for Implementing Monetary Policy"; http://www.rbnz.govt.nz/monpol/about/index.html

[17] Similarly, the ECB devotes a lot of attention to its daily liquidity forecast and the volume of liquidity supplied in its MROs, despite the automaticity of its SFs, in order to keep the overnight market rate close to the minimum MRO rate.

[18] Bagheot, in 'Lombard Street' (1873): "Money is a commodity subject to great fluctuations of value and those fluctuations are easily produced by a slight excess or a slight deficiency of quantity. Up to a certain point, money is a necessity. If a merchant has acceptances to meet tomorrow, money he must and will find today at some price or other. And it is this urgent need of the whole body of merchants which runs up the value of money so wildly and to such a height in a great panic. On the other hand, money easily becomes a 'drug', as the phrase is, and there is soon too much of it."

consequently be flat and around the policy rate, *provided* the central bank is expected to supply[19] the amount of liquidity the market needs at its policy rate.

If the start/end of the maintenance period and the policy decision dates do not coincide, then the market may have to factor in different policy rates in a given maintenance period, and so the yield curve to the end of the maintenance period may not be flat. If there is strong speculation that rates might change during the maintenance period, this will influence the timing of reserve holdings.

If a central bank reviews its official rates at irregular intervals which are not pre-announced, there will be some level of market uncertainty, and the short-term yield curve is likely to be more volatile as banks speculate about future changes in official rates.

ii: Externally-framed monetary policy

In a fully liberalised system, including full convertibility on the external current and capital accounts, the central bank cannot guarantee maintaining both a domestically framed (independent) monetary policy - whether tactically achieved through interest rates or foreign exchange operations - and an exchange rate target. If it has an independent target for interest rates, for example, it will eventually have to accept the market-determined exchange rate. If, on the other hand, it targets the exchange rate it will have to accept the interest rates necessary to keep the exchange rate stable. Countries with a hard exchange rate peg typically use the yield curve of the target currency, sometimes with a small premium.

Market imperfections or administrative controls may enable the central bank *temporarily* to set both domestic monetary policy and the exchange rate. This could be achieved, for example, through sterilised intervention[20] or the introduction of controls to put a wedge between the domestic financial market and the foreign one, such as controls on foreigners' purchases of domestic financial assets, or indeed controls on cross-border capital transfers by residents. But such controls tend to break down and/or become less effective over time if heavy reliance is placed on them[21]. Therefore, over any longer period, the central bank will need to choose whether to set its own independent monetary policy, or to target the exchange rate and accept the monetary policy of the country to which the exchange rate is pegged.

[19] In the case of all these three examples, the market has a structural shortage of liquidity.

[20] Sterilised intervention is where the central bank offsets the monetary impact of its foreign exchange operations. For example, the central bank may sell domestic currency and buy foreign exchange to prevent the domestic currency from appreciating. It could then "sterilise" the consequential increase in the money supply through, for example, selling bills or increasing reserve requirements (though this would tend to increase interest rates and so put further upwards pressure on the exchange rate).

[21] See *Handbook No 2* "The choice of exchange rate regime".

A target for the exchange rate is seen in its strongest form where a currency board system is in operation (e.g. Argentina (until 2002), Bulgaria, Estonia, and Hong Kong) or in a monetary union when the national central banks cease to have any independent role in monetary policy (e.g. the euro area)[22]. A more flexible approach is the European Exchange Rate Mechanism (ERM II) [23] for countries wishing to join Economic and Monetary Union: the currency is tied to the euro and is able to fluctuate within a band around the central rate (some ERM members eg Estonia have a self-imposed more restrictive regime than required by the ERM).

To achieve its exchange rate target, a central bank could conduct domestic operations in order to keep interest rates at the level necessary to keep the exchange rate at the desired level. These operations would be along the lines detailed in the first section of this chapter. Alternatively, the central bank could stand ready to deal in foreign exchange with the market, though the credibility of this strategy would depend on having sufficient foreign exchange reserves. If a central bank were to adopt a currency board framework, sufficient foreign exchange reserves would be a pre-requisite. Normally, 'sufficient' is understood to mean exceeding central bank liabilities.

[22] The strongest form of an exchange rate target is 'dollarisation' where dollars (or some other foreign currency) are used in place of domestic currency as a means of payment e.g. Ecuador with effect from 2000.
[23] Membership of ERMII includes: Denmark, Estonia, Lithuania and Slovenia as at October 2004.

3 BALANCE SHEET OF THE CENTRAL BANK

iii: The structure of the balance sheet

The liabilities of the central bank - notes, required or contractual bank reserves, and free bank reserves - are called "reserve money" or "base money". The economy requires reserve money because cash and free reserves at the central bank are the ultimate means of payment, carrying no credit risk; and the banking system intermediates between the central bank and the rest of the economy in obtaining the required liquidity. Central banks can control or influence the level of short-term interest rates or the exchange rate – the internal or external price of the currency - by exploiting their monopoly over the supply of domestic currency reserves to commercial banks, to the extent that banks and their customers have a demand for these reserves. If the central bank's balance sheet is liability driven – reserve money is supplied only to meet demand – the central bank is in a strong position, as it can determine the terms (ie the price) on which demand is met. By contrast, if its balance sheet is asset-driven, there will typically be an excess supply of liquidity in the market and the central bank's role as monopoly supplier of liquidity is weaker.

Table 1: stylised central bank balance sheet

Assets	*Liabilities*
Foreign assets (net)	Notes (and sometimes coin)
Lending to government (net)	Required or contractual bank reserves
Lending to banks	Free bank reserves+
Other items (net)	Liquidity draining operations*
	Capital and reserves

+ including voluntarily-held reserves

* any transactions with banks to offset surplus liquidity, such as a deposit auction, use of standing deposit facilities, and sales of central bank bills.

For liquidity management purposes, it is important to focus on balance-sheet items which reflect a cash-flow. For instance, a foreign exchange transaction will result in a cash flow, affecting Net Foreign Assets and another balance sheet item (depending on the counterparty and balance sheet structure); but foreign exchange revaluations will not. Changes in 'Capital and reserves' may be a counterpart to a cash flow elsewhere; but it is the counterpart, rather than the change in this item per se, which needs to be taken into account.

Demand for notes The demand in the economy for notes is normally substantial in relation to the

central bank's balance sheet. If cash is supplied to the population, via the banks, on demand, then by definition there should be no excess supply. But if cash in circulation is supply-driven – for instance, if the government pays salaries in cash (and particularly if this is financed by borrowing from the central bank) – there may be excess supply. In this case, the population will try to get rid of excess holdings, either by depositing in banks if they pay interest (and so increasing the level of banks' free reserves), or buying goods or foreign exchange (both of which will tend to be inflationary).

The demand for cash will vary not only in relation to nominal GDP, but also to the level of interest rates (the opportunity cost of holding cash will change), development in non-cash payment systems (substitutes for cash), the perceived soundness of the banking system (the risk of substitutes), and the credibility of the central bank (affecting the level of dollarisation, if any[24]), including the level of trust in domestic cash (the risk of counterfeiting will reduce willingness to hold it).

Demand for required reserves 'Demand' for required reserves is essentially a function of administrative decisions by the central bank rather than reflecting a functional need; although when reserve averaging is allowed and especially when those reserves are remunerated, the requirement may not constitute an effective constraint on the banks[25]. If required reserves are not fully remunerated and are set at a high level, or if there are different levels for different commercial bank liabilities (eg varying between current and time deposits, or domestic and foreign currency deposits), they may provoke changes in the banks' behaviour, or disintermediation of the banking system, in order to reduce the burden.

Demand for contractual (voluntary) reserves will exist if such reserves are remunerated, and can be used by banks for liquidity management via averaging – for example, as planned in the Bank of England's money market reforms[26].

Demand for free reserves Banks also usually need to hold free deposits at the central bank for settlement purposes, as the government and other clearing banks typically demand payment in reserve money, rather than in balances with a commercial bank which bear credit risk: payments between banks are usually settled by transfers between accounts at the central bank. As free reserves are not normally fully remunerated, they tend to be held at a minimum by commercial banks. That minimum may be

[24] If there is a perceived risk of substantial devaluation or high inflation, domestic reserve money may no longer be seen as the 'ultimate' or safe means of payments. Foreign currencies – or sometimes even forms of barter – may be substituted.

[25] For instance, if reserve requirement levels are low, vault cash counts towards reserve requirements and reserve balances can be used intraday for payment system purposes, then a bank's operational need for vault cash and settlement balances may exceed the reserve requirement. It is then no longer an effective, or "binding", constraint to the extent it does not change the bank's behaviour.

[26] The Bank of England's plans for fully remunerated, voluntary reserves are an innovation, although they will be in some respects similar to averaging around zero, with securities pre-pledged to the central bank. In both cases, the commercial banks have some degree of freedom in choosing the level of contractual reserves/pre-pledged securities – and thus of liquidity so provided – and the effective cost of holding and using such reserves is virtually zero.

substantial, if liquidity management is difficult and the penalties of being in overdraft are high. To the extent there is a cost to holding them, excess free reserves will lead banks to take actions to try to reduce the cost. Such actions could include increasing lending, bidding for securities in the domestic market (so pushing down the yield), cutting deposit rates offered, or buying foreign exchange. Excess free reserves will typically be seen where the central bank's balance sheet is asset driven: where there is a history (and perhaps still current practice) of monetary financing of the government; where the government is borrowing abroad to finance domestic expenditure, and sells the foreign exchange to the central bank; or where there is a managed or fixed exchange rate and current or capital inflows, forcing the central bank to make net purchases of foreign exchange and so create domestic liquidity as its counterpart. In balance sheet terms, this means that the asset items 'net foreign exchange reserves' and/or 'net lending to government' expand, with a counterpart liabilities expansion in commercial bank deposits.

If reserves are remunerated at, or at close to, market rates, banks will choose to hold a certain level for liquidity management purposes. Commercial bank current accounts (Exchange Settlement account) held at the Reserve Bank of Australia, and remunerated at 25bp below the official policy rate, are used in a way similar to voluntary reserve averaging.

The level of free reserves will be affected from day to day by net transactions between the economy and the state sector (the government plus central bank). For instance, if the banking system has to buy foreign exchange from the central bank to satisfy customer demand, or if net payments are due to the government (eg on tax payment days), the banking system may start the day with the desired minimum level of free reserves, but still need to borrow from the central bank in order to make the required payments. Such demand may net to zero over time; but from day to day can result in substantial net flows in either direction. In RTGS payment systems there will also be demand for intraday liquidity, for payment system purposes; but this does not affect the end-of-day balance sheet of the central bank.

Liquidity draining operations are a sub-set of monetary operations, and are covered in detail later. They may simply take the form of deposits at the central bank, or could involve the sale of securities.

The central bank's main assets - the counterpart of reserve money - are net holdings of foreign exchange (net foreign assets), net lending to the government, and lending to banks.

Net foreign exchange reserves will be built up if the central bank buys foreign currency in the market or from the government, or if the government 'gifts' them to the central bank (as part of its capital, for instance). They may be substantial if a substantial part of the government's income is in foreign

exchange (whether current earnings, donor flows, or borrowing[27]), or if there are private sector current or capital inflows and the central bank wants to prevent too much appreciation of the exchange rate. In some countries, foreign exchange reserves on the central bank's balance sheet will be offset by foreign exchange liabilities, and they may not all be freely available to the central bank. For instance, if the central bank manages a stabilisation fund for the government and this is shown on balance sheet, part of the foreign exchange assets may effectively belong to the government rather than to the central bank. But a substantial asset-driven build-up of net foreign exchange reserves – eg because the central bank has to buy and hold the foreign exchange in order to meet an exchange rate target – is likely to be associated with an offsetting expansion in reserve money, and in particular in excess free reserves unless the central bank takes off-setting liquidity-draining action.

Net lending to government, as a net asset, is becoming less common globally, as the trend towards central bank independence is accompanied by a 'no monetary financing' rule – ie central banks do not lend, or at least do not extend new loans, to government. In some cases, limited short-term lending to government is permitted[28]. In some cases it is unconstrained, and if used in an uncontrolled way will cause monetary management problems for the central bank. Monetary financing constitutes asset-driven expansion of the central bank's balance sheet. Often, such asset-driven holdings carry a sub-market interest rate, and cannot easily be used in monetary operations. But a holding of government securities need not be asset driven: many central banks will buy and sell government securities in order to influence the composition and level of their other assets and liabilities.

Even if the government has positive net domestic currency balances at the central bank, there will still be day-to-day fluctuations in the balances – as it spends money, or receives tax income – and these will impact reserve money, and in particular banks' free reserves held with the central bank. Normally a central bank will aim to structure its operations such that the commercial banks' free reserves at the end of each day, or the average end-of-day figure in a maintenance period, is in line with those banks' demand. Too much or too little will have an adverse impact on the price of money (short-term interest rates or the exchange rate). Intraday flows may also be important, especially if the market is not certain they will be offset by central bank action.

Lending to banks is a counterpart to liability-driven changes in the central bank's balance sheet. Normally it will only occur in volume if the market as a whole has a structural shortage of liquidity, and

[27] For instance, oil exporters will see an increase in income when the world oil price rises; some poor countries see large – in relation to GDP – donor flows eg Malawi, Uganda; and some governments finance domestic expenditure by foreign borrowing.

[28] For instance, a 1997 agreement between the Reserve Bank of India and the government permits a fixed amount of lending, at the bank rate; any excess is both time-limited and subject to a penal interest rate.

needs to borrow from the central bank to meet the economy's demand for cash, or the banking system's demand for central bank balances. Occasionally it might be driven by a specific need eg if an individual bank runs into difficulties and the central bank provides some finance. The central bank will not try to force loans on the market, nor should the market seek more than it needs.

iv: Using the central bank's balance sheet

Re-arranging the balance sheet identity in Table 1 gives:

Equation 2*:*

$$
\begin{aligned}
\textit{Free bank reserves} = \quad & \textit{net foreign assets} \\
& + \textit{net lending to government} \\
& + \textit{lending to banks} \\
& + \textit{other items (net)} \\
& - \textit{notes} \\
& - \textit{required or contractual bank reserves} \\
& - \textit{liquidity draining operations}
\end{aligned}
$$

If free (i.e. freely available for the banks' use) reserves are remunerated at a varying margin below the central bank's policy rate, the banking system's demand for free reserves may, in theory, increase when the spread declines, and decrease when it increases[29], as the opportunity cost of holding these reserves will change. If the banks' demand for free reserves is constant (at current interest rates) and the central bank wants to keep interest rates unchanged, it needs to perform operations – via net lending to the banking system - so as to leave the banks' free reserves unchanged. If not, it can be seen from equation 2 above that an increase in the supply sources of money and/or a reduction in the demand for notes or required or contractual reserves will result over time in an increase in free reserves and a corresponding decline in short-term interest rates (and/or weakening of the exchange rate). This is notably the case if the banks have surplus liquidity. A surplus will result in short-term rates drifting down to the SF deposit rate or, in the absence of such a facility, to zero. Conversely, a reduction in the supply sources of money or an increase in the demand for notes or required reserves will result in a decline in free reserves and an increase in interest rates towards the credit SF rate if the central bank takes no offsetting action.

Perhaps the key insight here is that if a central bank's liquidity management is effective, so that the actual level of reserves is in line with demand without the need for any significant resort to standing

[29] Demand may be affected by other factors e.g. enhancements to the payment system may reduce banks' need for precautionary settlement balances. Banks will be more prepared to invest in liquidity management or payment systems if the identifiable cost savings are larger.

facilities, it will be in a strong position to control the price of short-term money. Liquidity management is an essential part of monetary operations – not because the central bank is in any way following a volume target, but simply because if supply at the policy rate does not meet demand – whether it is too high or too low - the price in the market will move towards one of the SF rates.

In any case, because the central bank cannot tightly control net lending to banks on a day to day basis nor, in many cases, lending to the government or intervention in the foreign exchange market, it cannot usually fix the supply of reserve money exogenously, even if it wanted to do so[30]. This is particularly true in the case of lending to banks if there is a market shortage. To withhold supply altogether would mean either that banks could not supply notes to customers, or that one or more banks might not be able to settle their obligations in the payment system – in both cases, at the risk of damaging the credibility of the banking sector and possibly generating financial instability. In the very short-term, a central bank will take an accommodative approach to the economy's demand for liquidity, and use the price of money to influence future demand. Its monetary policy control levers must therefore be price rather than volume oriented.

A central bank can, for instance, limit supply in its OMO operations, forcing banks to increase borrowing at the more expensive SF credit rate, and thus pushing market rates up (in the case of a market shortage; or allowing rates to drift down to the SF deposit rate, in the case of a market surplus). This might be expected over time to lead to reduced demand for reserve money whether because the effective increase in interest rates slows loan demand, and lower balance sheet growth means lower growth in required reserves; or because slower GDP growth reduces demand for transactional cash. This is an approach that in the past has been used by many central banks. However, if the central bank's monetary policy judgement is that there is a need to increase the level of interest rates, it would be more transparent to change its policy rate, rather than to force the market to borrow varying amounts at two different rates (the policy rate and the SF rate). In stable market conditions, the policy rate can be reviewed at regular intervals – eg monthly as in the UK and the euro area – and operations simply implement that policy. The operations themselves do not send a signal. In more volatile market conditions, there may be more 'news' to which the central bank needs to react at frequent, but irregular, intervals. It may be more difficult in such conditions to have a clear separation between policy decisions taken regularly and publicly announced, on the one hand, and daily operations on the other. But in general, the more the two are separated, the clearer will be the policy signal.

[30] There are exceptions. In some countries, the impact of government cash flows on the central bank's balance sheet are neutralised with the debt agency conducting offsetting operations with the financial markets (e.g. Canada and the U.K. – see chapter 4 for further details on U.K. government cash management). Moreover, for countries which have a purely floating exchange rate there should not be any changes in net foreign assets (other than revaluation effects, which do not add to the flow of reserve money).

v: Shortage or surplus

Most central banks would prefer to operate with a structural shortage of market liquidity, although in practice most face a surplus. A shortage forces the banking system to borrow from the central bank, so that the central bank can enforce its desired level of interest rates: the banking system has no choice but to participate in central bank lending operations, as the central bank is the monopoly supplier of needed reserve money. The banks can underbid OMOs, but will then need to use SF borrowing to cover the residual shortage; as this will be at a penal rate, such behaviour is unlikely to persist. By contrast, if the banking sector has a surplus of liquidity, it does not have to participate in liquidity-withdrawing operations by the central bank eg deposit auctions or sales of securities. It could simply leave the excess in a current account with the central bank; or could try to switch into foreign exchange.

There are also balance sheet implications. If the market is short, the central bank receives interest on its lending to the banks, but where there is a surplus, the central bank has to pay interest if it is to drain excess liquidity. This may – and in practice frequently does - make a central bank reluctant to tighten the policy stance when necessary. There is always a cost to draining a surplus, or switching from a structural surplus to a deficit – in a sense, the cost is the counterpart to past or current policy decisions on government financing or exchange rate management. Understanding the root cause of the surplus may help in determining who should bear the cost of addressing it.

Reserve requirements could be increased to offset a market surplus; but this would only benefit the central bank if they are not fully remunerated. In this case, the cost of draining would be imposed on the economy, intermediated via the banking system[31]. Generally, this is an inefficient way of covering the cost, because of the impact on the economy as a whole. In some countries, the Ministry of Finance may agree to issue domestic currency securities and leave them on deposit with the central bank. This does not avoid the cost of draining, it simply means that the central bank does not pay it. There are benefits to this route: the central bank's balance sheet will be stronger, and it is less likely to feel constrained in monetary policy implementation. But Ministries of Finance will sometimes be reluctant to issue securities at the behest of the central bank, or will not want to do so beyond a certain level. Some will not do so at all.

The central bank could run deposit auctions, or issue its own securities. The National Bank of Poland has been an example of the latter[32]: from 1995 to 2000 (when the exchange rate peg was dropped) it

[31] Although often referred to as a tax on the banking system, the banks will of course adjust their interest rate structure in order to pass on the cost.

[32] Due mainly to sterilization of heavy capital inflows, and monetization of government spending before the enactment of the National Bank of Poland Act in 1997.

issued central bank bills to reduce the structural surplus, and from 2000 began to sell government securities from its portfolio. An alternative, for some central banks, might be to sell foreign exchange. Again, this does not eliminate the cost of draining the surplus; but if the securities or foreign exchange are sold at a market rate (and provided any impact on market rates does not run counter to other policies), no policy signal should be sent through the long-term drain of liquidity. Further information on surplus liquidity can be found in the CCBS Lecture Series No 3 "Surplus Liquidity: Implications for Central Banks".

4 LIQUIDITY FORECASTING

A central bank will need to conduct open market operations in each maintenance period (whether that is a day or a month) in order to keep its tactical target stable (unless it is operating a pegged exchange rate, when standing facility operating at the policy rate will suffice). In order to do this efficiently the central bank needs a reasonably accurate forecast of the factors (the main items on its balance sheet) affecting the banks' free reserves within the maintenance period. In a system where reserve requirements apply on average over a period, say two weeks or one month, or where the banking system can access short-term lending and deposit facilities at the central bank without too large a penalty, small and temporary[33] autonomous shocks to the banks' liquidity can be absorbed[34] without the need for daily OMO. But whether the maintenance period is a day or a month; and whether the operating target is interest rates or the exchange rate, the central bank needs to be able to forecast its balance sheet within the maintenance period if it is to be able to control market conditions accurately.

With an accurate liquidity forecast it is possible to announce both the expected quantity (i.e. the market's needs) and the price (set by the central bank/government) of the central bank's operations. This does not mean that the central bank can necessarily fix both the price and the quantity of its transactions with the market. If OMO supply is equal to or less than demand, it can fix both (goods can be sold below the market-clearing price as long as there is no need to clear the market). What a central bank cannot do is to fix arbitrarily both the price and the volume of OMO without altering the relationship between its lever (the OMO) and its tactical target (the short-term market interest rate, or the market exchange rate). This is evident in countries where there is excess liquidity and the central bank is reluctant to drain all the excess at a market clearing price, because of the impact on its profit & loss. A certain volume of deposits can be taken, or securities sold, at the 'policy' rate; but if this leaves excess liquidity in the market, the market rate will drop below the OMO rate.

The level of market demand for OMO transactions with the central bank will vary depending on the perceived accuracy of the central bank's forecast, and the spread between OMO and SF rates. If a bank is confident that it does not need to borrow, and is doubtful of the quality of the forecast, it will be less likely to participate in an OMO; but if it is uncertain of its own needs but trusts the central bank forecast, it may participate in the expectation that it can on-lend any funds that prove to be surplus to requirements.

[33] In this context, 'small' is in relation to the normal level of banks' reserves; and 'temporary' means they are expected to unwind before the end of the current reserve maintenance period.

[34] Allowing banks to meet reserve requirements on average over the maintenance period implicitly acknowledges that the central bank is not concerned about short-term fluctuations in the level of reserve money.

Or if the opportunity cost of failure to borrow enough (the difference between the OMO and the SF rate) is high, banks may be more inclined to participate in OMO and risk holding excess balances (although this may be inefficient for the system as a whole).

In developed economies, the central bank will typically aim to forecast the liquidity needs of the market and provide the required amount. This liquidity provision is often carried out through counterparties who are obliged to distribute liquidity through the system. In order to forecast the amount of liquidity needed, the central bank needs to forecast net expected flows between the central bank/government[35] and the market, such as government security purchases/redemptions; government revenues (e.g. taxes) and expenditure (e.g. health, education, welfare etc); maturing money market transactions; net purchase of notes/coins by commercial banks from the central bank; and central bank intervention in the foreign exchange market. These are commonly referred to as 'autonomous factors' – because they are beyond the direct control of the central bank. The list is not exhaustive but gives an idea of the flows that are taken into account in the forecast. The most volatile element is normally the government revenue/expenditure, as it is often difficult to assess exactly when this will be booked, and if the central bank is operating on a daily basis, this can result in late swings to the forecast on a daily basis. In the U.K., (and e.g. in Australia and Japan) the forecast, and its main components, is published. The ECB publishes a forecast of the change in the autonomous factors for the maintenance period.

For some central banks, it is difficult to forecast liquidity, often because the flows of government revenue and expenditure are unpredictable or even unknown until after the event. In such circumstances, the central bank may simply ask commercial banks to advise them of their individual liquidity requirements. This may also happen if the interbank market does not function efficiently and therefore it is not possible to meet the system's needs through a small number of counterparties.

An alternative to asking banks directly would be to attempt to model the liquidity needs of the system. This technique can be used for the currency demands of the banking system, as they often follow a predictable pattern intra-week and through the year[36]. The Bank of England is continuing to develop improved modelling techniques for its notes in circulation forecast. However, for components such as government cashflows and net foreign assets, due to the large degree of discretion, and to seasonal fluctuations, and uncertainties within this, modelling techniques are less widely used.

[35] Assuming the government banks at the central bank.

[36] The demand for notes typically rises towards the end of the week and then unwinds at the start of the following week. Through the year, demand for notes is likely to increase ahead of public holidays such as Easter and Christmas and bank holidays and unwind following these holidays.

An example of the Bank of England's published liquidity forecast:

9:45 am	Initial liquidity forecast Stg xxxx mn shortage. A round of fixed rate operations is invited. The Bank's repo rate is xxxx%. The operations will comprise repos to xxxxxxxxxxxxx. Principal factors in the forecast: Maturing repo -xxxx Bank/Customer transactions xxx Rise/Fall in note circulation xxxxx Maturing settlement bank late repo facility -xxx Bankers balances above/below target xxx
9:50 am	Total amount allotted - Stg xxxx mn.
2:30 pm	Liquidity forecast revision Stg xxxx mn. Residual shortage Stg xxxx mn. A round of fixed rate operations is invited. The Bank's repo rate is xxxx%. The operations will comprise repos to xxxxxxxxxxxxx.
2:35 pm	Total amount allotted - Stg xxxx mn.
3:30 pm	Residual shortage - Stg xxxxx mn. A round of overnight repo operations to supply funds is invited at a rate of xxxx%. Deposit facility: offers of overnight funds are invited at a rate of xxxx%.
3:35 pm	Total amount allotted in overnight repo operations - Stg xxx mn. No use has been made of the deposit facility. Amount allotted to the deposit facility - Stg xxx mn. Net flows of overnight funds to/from the market - Stg xxx mn. Total liquidity provided to the market - Stg xxx mn.
4:20 pm	Final liquidity forecast revision Stg xxxx mn. Residual shortage Stg xxxx mn./No liquidity forecast revision. The settlement bank late repo facility is available./The settlement bank late repo facility will not operate today
4:30 pm	Stg xxxx mn has been provided in the settlement bank late repo facility.

The above forecast is that used in early 2006, ahead of the introduction of the new operational system, and is for the current day only. This will obviously change once reserve averaging over a one-month period is introduced. The example below of the ECB's liquidity statement provides information on the reserve requirement for the whole maintenance period, average holding to date, and a forecast of autonomous factors for the coming week (rather than to the end of the current maintenance period). As the euro-area commercial banks as a group typically hold reserves close to the required level throughout the maintenance period, the ESCB can aim to provide sufficient liquidity to offset the current week's autonomous factors, allowing within-period averaging to offset any errors between the forecast and the outturn for that week.

Example of the ECB publication on market liquidity

Daily liquidity conditions (EUR millions)		
Reserve maintenance period:	*08/02/2006 to 07/03/2006*	
Average reserve requirements:	157,663	
Figures as at	*22/02/2006*	
Average current acc. holdings in the MP:	158,169	
Current account holdings:	157,528	
Use of the marginal lending facility:	0	
Use of the deposit facility:	32	
Autonomous factors:	250,458	
Forecasts of autonomous factors (EUR millions)		
Estimate on 21/02/2006 of average daily autonomous factors for the period *20/02/2006* to 27/02/2006:		253,400

Allowing reserve averaging can aid the central bank in coping with the volatility in the autonomous factors. While the central bank still needs to forecast the market's liquidity position accurately over the maintenance period, the market does not need to meet a particular liquidity target on a day-to-day basis during the period, thereby reducing the need for forecasting autonomous factors on a day-by-day basis, and giving the market more flexibility in liquidity management.

Regarding government cashflows themselves, the central bank's forecasting ability can be improved through effective communication, not just with the Ministry of Finance (MoF), but also the individual government departments. Often MoF officials are not located in the revenue and expenditure departments and hence have little control over the timing, size and method of the cashflows. Furthermore, while many MoFs and government departments concentrate on monthly and annual totals, for liquidity forecasting it is the daily pattern of cash flows that is important. As such, many central banks have taken steps to improve the predictability of these cashflows by asking for a timetable of revenue and expenditure flows – preferably broken down on a daily basis – to be provided to them by the MoF / relevant government departments. In most countries, income tax flows follow a pre-specified schedule, though the profiles for corporation tax and value-added-tax may be more volatile. Some central banks require prior notification when there is a large transfer or when there is a significant and planned variance from the timetable. In some countries, there is an agreed target balance for the government's account with the central bank[37], while in others, the central bank has the right to shift at its discretion the government's funds from their books to those of the commercial banks.

[37] This is useful for central bank liquidity management providing the time period that the government has to meet its target balance matches the central bank's maintenance period.

Encouraging the government to bank with the commercial sector, through for example paying a below market rate of interest on deposits, would eliminate the impact of government cashflows on the central bank balance sheet, thereby enforcing the separation of monetary operations and government cash management. In South Africa, with the government's account at the central bank unremunerated, balances on the account are relatively small. Instead the majority of the government's funds are kept with the commercial banks: liquidity management is greatly enhanced as the bulk of the government's money is kept outside the central bank. This was also the case in Germany, pre euro, as the Bundesbank could not remunerate any deposits. However it is rare for the government's main accounts to be held outside of the central bank: the protection and non-commercial neutrality of the central bank act as a strong attraction.

With effect from April 2000, U.K. government cash management was transferred from the Bank of England to the UK Debt Management Office (DMO). The motive behind this was predominantly to clarify the roles of the Bank of England and HM Treasury and so avoid any perception of conflicts of interest in market operations conducted by these institutions, as the Bank has had responsibility for monetary policy since 1997, while a Treasury agency (the DMO) is responsible for debt management. The DMO operates in the market on a daily basis in order to offset government flows to and from the market, like the treasury department of a large commercial company. In effect this means that changes in the central bank balance sheet item 'net lending to government' are expected to be zero on a day-to-day basis, considerably facilitating the forecast of autonomous factors. The DMO manages this first through a weekly Treasury bill programme (rough-tuning) and then through daily fine-tuning market operations which are conducted on a bilateral basis with set counterparties, predominantly through the domestic-currency U.K. government bond (gilt) repo market. The DMO would therefore plan to run down the Treasury bill stock in months of positive cash flows to the government and then increase it in months of higher net government expenditure. The DMO and Bank of England work to avoid any conflicts between their respective objectives. The Bank continues to set short-term interest rates: the DMO is a rate taker in its market operations.

vi: Direct controls

Direct controls are becoming ever more rare, essentially because they do not work well, if at all. They are typically directives given by the central bank to control the *quantity* or *price* (interest rate) of money deposited with commercial banks (and sometimes other financial institutions) and credit provided by them; and perhaps also to control the exchange rate used in transactions with banks. Ceilings on the growth of bank lending or deposits are examples of *quantity* controls. Maximum bank lending or deposit rates, or official exchange rates, are examples of *price rate* controls. Such controls do not utilise the central bank's balance sheet.

There are a number of major disadvantages of direct controls, related to the constraint they impose on market development and the fact that they become less effective over time as loopholes are found:

- they may prevent economically justifiable transactions e.g. a company may be willing to pay above the maximum rate to finance a profitable transaction, and a bank may be willing to lend, but controls prevent the transaction from taking place;

- *bank-by-bank* controls hold back competition in financial markets which could benefit both borrowers and depositors. For example, they prevent competition from allowing more efficient banks to expand their deposits and credit by offering higher deposit rates and lower lending rates;

- *selective* credit controls - credit controls on some banks but not on favoured ones (for instance on banks that lend to specific sectors or regions) - distort markets and impose a cost on the economy which may not be quantified.

- direct controls encourage disintermediation into non-controlled (so-called "grey") markets or abroad. So, over time, direct controls become less effective as lenders and savers search for ways to circumvent them. For example, in an increasingly open and integrated world financial system, companies and households could borrow from abroad, thus circumventing controls at home. In other words, they may control statistics, but not actual economic behaviour.

The advantages normally cited in support of direct controls are that they can be an effective way for the central bank to control the price or *maximum* quantity of bank credit, particularly in a *temporary* crisis;

and they may constitute the most effective, rapid or practicable approach in circumstances of very underdeveloped financial markets, or where the central bank has inadequate techniques of indirect monetary control, or in a crisis situation. Some central banks have experimented with exchange controls as a short-term measure to control capital flows, and thus affect liquidity and its pricing, but it is hard to point to any clear cases of success. This Handbook does not explore capital controls.

Typically, the advantages, if any, of direct controls are of a short-term nature, and the disadvantages increase over time. They are not recommended.

vii: Indirect instruments

An important reason for financial liberalisation is to develop a system which promotes an efficient allocation of savings and credit in the economy. In the monetary area, financial liberalisation involves a movement away from direct monetary controls towards indirect ones. The latter operate by the central bank controlling the price (or in theory the quantity) of the supply of its own liabilities - reserve money - which in turn may affect either (i) market interest rates and the quantity of money and credit in the whole banking system or (ii) the exchange rate.

Instruments used in monetary operations are often divided into three basic types:

- Open-Market Operations (OMOs), which are conducted at the initiative of the central bank but with voluntary participation by individual counterparties in the banking system; OMOs may be conducted at pre-announced trading sessions (which could include auctions) or at any time of the central bank's choosing. Using OMOs the central bank either provides funds to the market by lending against collateral, through repo[38] or by buying assets (securities or foreign exchange), or withdraws funds from the market by taking deposits, by conducting reverse repo, or by selling assets (securities or foreign exchange).

- Standing Facilities (SFs), which are normally defined as borrowing or deposit facilities available at the initiative of banks (and sometimes other financial institutions), usually within parameters set by the central bank; lending by the central bank is almost always collateralised. Standing facilities can be used to provide a safety value for the market's liquidity management: the credit facility allowing banks to borrow from the central bank, the deposit facility as an option for placing excess funds.

[38] A sale and repurchase agreement. See *Handbook No. 16* (Repo of Government Securities) for more detail. All references to repo are from the directional point of view of the market counterparty (as opposed to the central bank).

- Reserve Requirements, which can be used to alter the short-term demand for reserve money and thus the short-term interest rate (or possibly just the spread between deposit and lending rates), although they are somewhat imprecise and hence are regarded as a "rough tuning" instrument. Since banks can adjust their balance sheets in response to reserve requirement changes, the longer-term effect may, rather, be on the degree of banking intermediation. Remuneration of reserve requirements, or the use of remunerated voluntary reserves, removes their impact on interest rates. The addition of reserve averaging transforms them into a form of non-penal standing facility, by allowing banks to manage short-term liquidity shocks at their initiative.

Most central banks in developed market economies use a mix of all three. Normally, the rate structure of OMOs and SFs is used to steer market prices (short-term interest rates, or the exchange rate). Fully-remunerated reserves do not have a price impact; and where there are not fully remunerated (as in most countries), they are not normally used actively to steer interest rates.

If both types of SF are available and are set for the same maturity (normally overnight), a corridor will be created with the lending rate setting an upper ceiling to short-term market rates, the deposit rate the floor. The central bank will need to consider the width of this corridor carefully (i.e. how penal it should set the interest rates on the facilities with respect to its OMO rate). A wider corridor (i.e. facilities with significantly penal interest rates) will encourage market participants use the money market, or to increase holdings of voluntary reserves, and use the facilities only as a last resort. The trade-off to this may be undue interest rate volatility at this maturity because of market imperfections; and to some extent, this volatility will feed through along the yield curve.

Some countries have given standing facilities a greater prominence in guiding the short term interest rate structure. Australia, Canada and New Zealand and more recently the U.K. operate with a narrow corridor (50 basis points) standing ready to deal with their counterparties on demand at both the upper and lower rates.

In many countries, the OMO does not play a significant role in guiding interest rates either because poor liquidity forecasting makes it hard to use effectively, or because there is surplus liquidity in the market and the central bank is reluctant to pay the full cost of draining it. In this case, one of the SF rates will tend to guide market rates: where the market has a structural surplus of liquidity, this will be the deposit SF rate, since that is the one banks most expect to use. Market rates will at times jump to the SF credit rate; the resultant volatility can discourage market development, because of the uncertainty involved.

Importantly, all three instruments can support short-run liquidity management. In developed markets, central banks will typically use a combination of OMOs and reserve averaging to support liquidity management, with SFs acting as a safety valve. These mechanisms help to smooth the impact of liquidity flows on short-term market rates, and allow the central bank's policy rate to have a clearer and stronger effect. In a number of developed countries the trend has been to give increasing weight to reserve requirement averaging, as this allows banks to manage their own day-to-day liquidity position. Some countries also still use changes in the level of reserve requirements as a medium-term liquidity management tool, but this is increasingly unusual.

6 OPEN MARKET OPERATIONS

OMOs are a very flexible monetary instrument, and the involvement of individual institutions is on a voluntary rather than compulsory basis[39]. OMOs can be performed frequently and in any quantity and are therefore a useful method of liquidity and short-term interest rate management. They help to foster financial competition and market development. However, most OMOs are in fact no longer conducted in the open market. Historically many central banks did conduct operations in the market, at market prices and on a bilateral basis; the policy rate was that applicable to a discount, or Lombard facility (a credit SF), which was above market rates. Nowadays, OMOs tend to be set-piece multilateral operations conducted with a pre-determined group of counterparties and at or close to a policy rate.

viii: Primary securities markets

OMOs can in principle be performed in the primary securities market, through new issues of short-term government or central bank bills[40] to withdraw liquidity (issuing less than the volume maturing, on roll-over, will increase market liquidity). Using government securities will require the appropriate level of co-ordination between the central bank and the government debt manager, as the same instrument in the same (primary) market is being used for both monetary and debt management. Co-ordination is needed because the timing of government debt sales required to finance fully the budget deficit will not necessarily be consistent with the central bank's liquidity management needs. On the other hand, while issuing central bank bills will help to promote the independence of the central bank, there will be the associated issuance costs[41]. Some commentators suggest that they may further hamper market development as the existence of both central bank and government securities may split thin liquidity even further and cause confusion for investors who may struggle to price the relative creditworthiness of the two types of securities. But this argument may not hold: no central bank would suggest that the private sector should not issue securities on the grounds that this would fragment the liquidity of existing government securities. And if the alternative to central bank bills was deposits at the central bank, it is far from clear that market liquidity would be damaged.

[39] Although as has been noted, the Bank of England intends to introduce reserve holdings on a voluntary basis.

[40] Domestic-currency liabilities of the government (treasury bonds or bills) or the central bank (central bank bills) are homogenous and normally carry little credit risk and hence are the instruments most commonly used in OMOs in developing financial markets.

[41] The central bank rather than the government incurs the *direct* interest rate cost of bill issue though it will earn interest on the counterpart assets on its balance sheet. Although *presentationally* this will reduce the central bank's profits, the final cost is still borne by the government to the extent that central bank profits are normally remitted to the government periodically. Nevertheless if draining liquidity leads to a central bank loss, it could affect the central bank's independence.

A potential drawback with the use of primary market sales of securities, particularly government securities, is that they will tend to have a longer maturity than ideally used for monetary policy operations, and it may therefore be difficult to use them for interest-rate setting. They can still be used for rough tuning liquidity management.

ix: Secondary markets

While primary markets are the more common channel in the early stages of financial liberalisation, secondary markets become the market of choice once they have been established. Secondary markets offer the central bank greater flexibility – dealing can be on a secured basis in either direction - and operating in this market may boost market liquidity. Secondary market operations (and standing facilities) can make use of private sector paper - in a few countries there is little choice, as there are insufficient government securities available, or they may be held by long-term investors rather than banks - but the central bank should ensure that this is of a sufficiently high credit quality. In this *Handbook,* secondary market operations are defined to include deposits and collateralised lending, outright transactions in suitable assets, repurchase agreements (repos) using securities, and foreign exchange swaps.

For operations in the secondary market, an important distinction exists between, on the one hand, transactions which are later reversed (repo, foreign exchange swaps, deposits, collateralised loans) or which use very short-dated securities, and, on the other, outright transactions involving longer-dated securities or foreign exchange. The initial money-market effects - the injection or withdrawal of liquidity - are the same in each case; but the wider effects differ. If a transaction is to be reversed - whether by re-sale of a security or foreign exchange, or return of collateral on repayment of a loan - the underlying exposure of the banking sector to the relevant securities or foreign currency is not affected by the money-market transaction. The market price of the relevant security or foreign currency should not, then, be affected by the money-market operation[42].

By contrast, the outright purchase or sale of longer-dated securities or foreign exchange does affect the underlying exposure of the banking sector to those assets, and is likely therefore to affect their market price. In other words, outright transactions of this sort may affect prices in the securities or foreign exchange markets, as well as money market liquidity. While this may happen to coincide with desired policy changes – for instance if the central bank is managing the exchange rate - often it will not do so. Central banks consequently tend to favour collateralised loans, repos or swaps when using longer-dated securities or foreign exchange for monetary operations, thereby exploiting a wider pool of collateral without directly affecting those particular markets.

x: Broad categories of Open Market Operations

The economy's need for central bank liabilities tends to increase over time, reflecting the increased demand for cash as consumer prices and real incomes grow. This increase in long-term demand may be met by the central bank either increasing the amount of revolving short-term lending (as the U.K. does at present, though this is under review), or periodically making outright purchases of longer-dated securities (as the US Federal Reserve Bank does), or by purchasing foreign currency outright.

When the banking system has a *temporary shortage* of reserves (i.e. is in need of liquidity), the central bank has a number of options as to how it might provide liquidity to the market through OMO. It could:-

- provide collateralised loans to the banks with a relatively short maturity;
- purchase outright short-dated securities or foreign exchange;
- offer repo transactions[43] where the central bank buys securities (with original maturities of any length) from the banks with an agreement for their resale at a specified price at a given future date;
- undertake short-dated foreign exchange swaps; the central bank purchases foreign exchange from the banks against domestic currency with an agreement for resale at a specified price (exchange rate) at a given date in the near future.

When the banks have a *temporary excess* of reserves, the central bank may:

- invite banks to place short-term remunerated deposits with the central bank;
- sell outright very short-term bills or foreign exchange;
- undertake reverse repos, the central bank selling securities with an agreement to buy them back at a specified price on a specified date;
- undertake short-dated foreign exchange swaps; the central bank initially sells foreign currency and purchases domestic currency.

Foreign exchange is still widely used in developing and transitional economies where domestic-currency markets may be less well developed, although of course its use depends on the availability of foreign exchange in the first place. It may be preferable to use swap or repo transactions rather than outrights, because of the spill-over into the foreign exchange market (foreign exchange cash may be swapped and foreign-exchange denominated securities repo'd; the money market effect is the same). The pricing of a swap transaction should ideally be based on the same central bank intervention rate as used in other

[42] The fact that central banks typically conduct repo transactions under General Collateral (as opposed to a "Special") is another reason why the transaction does not affect the underlying price of the specific security.

operations. There is an additional consideration in countries which are partially dollarised: if foreign currency can be used in a similar way to the domestic currency, then a foreign exchange transaction will not have so much effect on overall transactional liquidity. Outright transactions will affect the exchange rate, and this may be desired. But swaps may be pointless from a monetary policy point of view[44].

As will be seen later, every one of these types of transaction can be used for standing facilities as well as for OMO. The difference will be seen in: who takes the initiative? Is the transaction priced at the policy rate or at a margin above or below it? And is the transaction multilateral (eg an auction, as is the case for almost all OMOs), or bilateral (as SF transactions must be)?

xi: Maturity of OMO

The central bank should consider whether or not it wishes to adjust the market's liquidity on a temporary or permanent basis. If the central bank wishes to adjust the market's liquidity position on a permanent basis (a structural shift), then outright transactions in foreign exchange or long-dated securities would be more suitable than repo, collateralised loans and foreign exchange swaps, all of which are designed for temporary (and reversible) adjustments to the market's liquidity position. One can distinguish then between short-term monetary operations which aim to affect short-term interest rates or the exchange rate and help liquidity management; and longer-term liquidity management operations, where the central bank is managing liquidity but not normally sending an interest-rate signal. As noted earlier, it is very unusual for central banks to seek to set interest rates much beyond a two-week maturity, and so unusual to use longer-term operations to influence interest rates.

There is a more important reason for keeping the maturity of operations relatively short. Longer-term rate-setting operations can dilute the impact of monetary policy decisions, and confuse the yield curve. Normally, a central bank will want any change in policy rates to affect the cost of its transactions with the market from the date of the decision, and to determine the yield curve until the date of the next scheduled policy meeting. Ideally, if the group which sets monetary policy (the MPC in the UK, the Governing Council in the euro area) meets once a month, then operations undertaken in between meetings should not significantly overlap the next meeting (and the reserve maintenance period should ideally be aligned with the policy meetings). If the market believes that the central bank will only adjust its policy stance at scheduled policy meetings, then the yield curve out to the next policy meeting should be flat. Beyond that, the market may speculate about possible future rate changes, for instance depending on its forecast for inflation. If the central bank conducts long-term interest-rate setting operations, and the banks think rates

[43] Here and elsewhere, repo operations are seen from the viewpoint of the commercial banks, so that a repo means the commercial bank sells the security to the central bank, in the first leg.
[44] Swaps may nevertheless be useful as a standing facility.

will rise, they will want to borrow as much long-term money as possible and deposit surplus liquidity short-term, resulting in 'pivoting' where short-term rates can fall if the market expects the central bank to increase its rates. Or if the central bank is draining surplus liquidity, the banks may not participate in operations, as they will not want to lock into low long-term rates ahead of an expected rate increase.

Longer-term price-setting monetary operations may result in the market's participation in OMOs and use of SFs being influenced by speculation, giving rise to unwanted distortions in the short-term yield curve. Removing the scope of the banking system to use OMO speculatively should therefore result in clearer policy signals and more efficient markets. In 2004 Q1, the ECB introduced a series of changes to its existing MROs and wider operational framework in order to improve the efficiency of its operations. These changes included adjusting the dates of the maintenance period for minimum reserves so that they now always start on the settlement day of the MRO following the Governing Council meeting at which the monthly assessment of the monetary policy stance is scheduled. This move was designed to help the banking system's liquidity management by ensuring that the maturity of a MRO did not cross over into another maintenance period, and that only one policy rate was in force per maintenance period. To support this, the maturity of each MRO was shortened from two weeks to one week. The Bank of England changed its operations in 2005, in order to prevent fixed-rate OMOs overlapping policy setting dates[45]. In the interim, the Bank of England has countered the risk of pivoting by indexing the OMO rate to the MPC rate, rather than fixing it at the MPC rate prevailing at the start of the transaction. Thus, if the MPC rate rises during the life of an OMO, the OMO rate adjusts accordingly.

By contrast if, for example, a six month maturity is used for OMO, then at any one time the pricing of the central bank's transactions with the market will reflect the range of policy rates set over the previous six months; and there may be significant speculation in the banks' use of the central bank's operations.

xii: Regular or irregular operations?

A central bank may hold regular, set-piece operations, where it announces in advance a credit or deposit auction, and where a relatively large group - all banks or all members of a restricted group - may participate on an equal basis; or irregular operations, undertaken often at short notice, in response to a perceived need. The latter may be sub-divided into irregular set-piece operations (similar to regular ones except in timing) and bilateral operations, involving one or more discrete or ad hoc deals, not announced in advance and possibly unreported afterwards.

[45] In the Bank of England's planned reforms: "Beyond the next MPC meeting, money market rates should be determined by what market participants expect the MPC to decide. Hence our objective is to have a basically flat curve, at the MPC's rate, out to the next MPC meeting." (Speech by Paul Tucker, July 2004.)

(a) Regular operations

Most central banks have a regular schedule of operations, since they anticipate a need to transact with the market at least once a week (certainly once in each maintenance period), and find it operationally simpler to use a fixed time each week.

Currently in the U.K. a group of money-market counterparties may be invited up to twice a day, at pre-determined times and publicly - on the wire services' screens - to bid for re-finance funds. They may offer UK government securities or EEA government debt for short-term repo. In both cases these are for same-day settlement. These are "fine-tuning" operations. (See Table 2). The Bank of England has also used longer-term repo operations at market rates to supply liquidity e.g. over the change over the year 2000[46] and in the run-up to the launch of the averaging system in 2006, when there were widespread market concerns about the availability of liquidity.

The ECB conducts weekly[47] Main Refinancing Operations (MROs). These operations play the principal role for the Eurosystem in steering interest rates, managing the market's liquidity and signalling the stance of monetary policy. In the MROs, the ECB provides liquidity through "reverse transactions" (either in the form of repo or collateralised loans) to its counterparties via tenders. These tenders were changed from a fixed rate basis to that of a competitive rate tender (with a minimum bid rate equal to the ECB's policy rate as set by the Governing Council) in mid 2000 to overcome the chronic overbidding that had developed[48].

In the U.S. on operating days (ie most business days) the Federal Reserve Bank of New York (Fed) announces the operation to its primary dealers via the Trading Room Automated Processing System (TRAPS) by around 9.30am; if this time passes, the market will know that the Fed will not operate that day. If it is necessary to use more than one operation (e.g. if a longer-term repurchase operation is also required), then the Fed will run this first at around 8.20am.

(b) Irregular operations

Irregular operations may be conducted in a number of ways. In some cases, bills are sold or purchased in response to unexpected short-term developments (shocks) to the economy. By definition, these cannot be

[46] Provision of three-month liquidity indexed to the Bank's repo rate (as opposed to the usual two-week fixed rate repos).
[47] The variability in the frequency of regular OMOs conducted by central banks is a function of whether or not reserve averaging is employed; the maturity of the OMO; the volatility and size of the flows of the autonomous factors versus the size of reserve requirements; and the extent to which the central bank wishes to eliminate short term interest rate volatility.
[48] The ECB had previously set the rate and restricted the volume provided, leading to increasing overbidding by banks which expected their bids to be pro-rated.

planned in advance, and the central bank will wish to conduct the operations quickly. This in turn suggests that the number of counterparties may need to be limited.

An example of this type of operation is the fine tuning operations of the ECB. These "aim to manage the liquidity situation in the market and to steer interest rates, in particular in order to smooth the effects on interest rates caused by unexpected liquidity fluctuations in the market"[49]. Their frequency and maturity are not standardised, with liquidity provided through quick-tenders. They might be used, for instance, at the end of a maintenance period in order to prevent interest rates diverging too far from the policy rate. On occasions, a surplus of liquidity is forecast for the U.K. banking system. On these days, the Bank of England absorbs the excess liquidity through a competitive rate short-maturity reverse repo tender.

The quickest way for a central bank to affect money market liquidity is through a transaction with a single counterparty, whether in the money markets, the securities markets or the foreign exchange markets (provided same day settlement is available). For instance, if a bank is offering funds in the interbank market, the central bank could take them, thus removing liquidity from the banking system. Some developed countries make occasional use of such irregular one-on-one operations. Indeed in the euro area, liquidity absorption is, in principle, executed via bilateral transactions.

But, though quick and simple, there are disadvantages to bilateral operations. Most importantly, not only are they not visible and may not be equitable, they may not distribute liquidity around the market as efficiently as a multilateral operation; and they lose the signalling impact (normally the most rapid). Moreover, in such operations the central bank's counterparty has knowledge about the central bank's actions (unless the latter can act anonymously through a broker) which is not available to the rest of the market, and this may give it a competitive advantage. If the central bank were to make regular use of such operations with a small group of counterparties, other banks might suspect the central bank of favouring the privileged few unfairly, and consequently become less willing to participate actively in the market.

Foreign exchange transactions conducted for monetary policy purposes tend to fall into the category of irregular operations, in part because a central bank's position in the foreign exchange market is rather different from its privileged position in its domestic markets; and it may be open to settlement risk in foreign exchange transactions - a risk which can be avoided in its domestic markets - and will therefore take a different attitude to its counterparties. In Switzerland, foreign exchange swaps were at one point the most important tool for monetary policy. However, since repo was introduced in 1998, in order to broaden access to its operations, it has replaced foreign exchange swaps as the major policy instrument.

xiii: OMO tenders: price or quantity

Theory says that the central bank can either offer to inject/withdraw a fixed quantity of liquidity and allow the banking system to bid for the interest rate (using either a competitive price or a common price auction structure); or set the interest rate and allow the banks to determine the volume. As indicated earlier, even if the central bank fixes the volume to be transacted, inviting the banks to bid the price, it is likely that the central bank does this with a view to the expected impact on prices bid; or that it gives a strong price guide, and will vary the volume allotted in line with its price target. The choice between a volume or an interest rate tender may depend on whether the central bank wishes to send a stronger signal (by setting a specific rate) or to receive information from the commercial banks based on their bids as to what they think the appropriate level of interest rates should be. If the central bank did not give the market *any* guidance via its OMO as to what it deemed the appropriate interest rate - for instance if it was following a strong money quantity rule - it could still ensure an upper (lower) limit on rates by setting a rate for its standing lending (deposit) facilities, but would have to allow a lot of volatility in between.

'Signalling' through varying the volume of OMOs used to be commonplace, and the market would scrutinise the central bank's operations for indications of any change in policy stance. However, this is now less common, as processes of setting tactical targets (e.g. interest rates) are more transparent, and the operations are simply designed to implement the rate that has already been announced to the market. For example, in the U.S., the FOMC set a target level for the "Fed funds" rate: the Fed decides how much liquidity to supply in its OMOs (undertaken in the repo market) on the basis of its forecast of reserve needs and in the light of the deviation of the Fed funds market rate from its target. The market is well aware of this when making its interest rate bids. The "Fed funds" rate is normally maintained within a narrow band around the target rate.

As already noted, the ECB adjusted its MROs from a fixed to a competitive rate tender in order to eliminate overbidding. While the minimum bid rate allowed in these tenders is equal to that of the ECB's policy rate, the fact that the market does not infer a policy signal when accepted bid rates show a small deviation from the policy rate reinforces the fact that operations are designed to implement only the pre-announced policy rate.

[49] European Central Bank: "The implementation of monetary policy in the euro area: General documentation on Eurosystem monetary policy instruments and procedures, February 2004", available at http://www.ecb.int/pub/pdf/other/gendoc2004en.pdf

xiv: The policy rate and shortage or surplus

If the policy rate is determined on the basis of that deemed appropriate to achieve the targeted inflation rate, or support a targeted exchange rate, or perhaps to achieve a monetary aggregate target, it should make no difference whether there is a market shortage or surplus of liquidity. The policy rate should be unchanged. This is clear in relation to foreign exchange OMO, supporting a particular rate, where the central bank must operate at the target rate in order to maintain it whether the market is buying or selling foreign exchange. The same should hold true for interest rate tools. But in practice, some central banks will have a higher policy rate when lending to the market than when withdrawing funds. This is likely to confuse the policy signal (see discussion in section 3.v).

In 2004, the Bank of England also announced that, in unusual circumstances e.g. if markets or settlement mechanisms for the collateral routinely used in the Bank's OMOs and real time gross payment system were disrupted, or if banks were facing more direct problems themselves, it would be willing in principle to accept U.S. government securities as collateral in its routine operations. The Bank would use the Fed as its custodian.

Table 2 Monetary operations in the U.K., from June 2006

	OPEN MARKET OPERATIONS	STANDING FACILITIES	RESERVES
INSTRUMENT	1. 7 day repo with the Bank 2. Overnight fine-tune repo with the Bank on final day of maintenance period (to inject or drain, as appropriate)	1. Overnight repo 2. Overnight deposit	No reserve requirements are in force, but banks may, by agreement with the Bank, hold voluntary, contractual reserves. The contracted level of reserves must be maintained, on average, over the maintenance period (normally 4 weeks), within a range of +/- 1%.
SECURITY	Any U.K. government security (Gilts, Treasury Bills, non-sterling marketable debt); and BoE Euro Bills and Notes Sterling-denominated securities issued by EEA central governments, central banks and major IFIs Euro-denominated securities issued by EEA central governments, central banks and major international institutions that are eligible in the European System of Central Banks' monetary policy operations	1. As for OMO 2. No security required	
INTEREST RATE BASIS	1 and 2 MPC rate 3 Market-determined rate	MPC repo rate + 100bp (- for deposit facility), reduced to +/- 25bp on the final day of the maintenance period	Contractual balances are remunerated at the MPC rate. Any excess is unremunerated; any overdraft is charged at twice the MPC rate.
FREQUENCY	1 Once a week 2 Final day of maintenance period 3 Once a month	Any time during opening hours of payment system	
COUNTER PARTY	OMO counterparties	Wide range of banks	Wide range of banks.
SETTLEMENT	1 and 2 Same day 3 T+1	Same day	Not applicable

7 STANDING FACILITIES

Standing facilities are used at the initiative of the counterparty (unlike OMO in which the central bank takes the initiative) and provide or absorb liquidity when other techniques have not been fully exploited. Consequently, while usually available at any time, they are normally only used towards the end of the trading day and tend to carry a penal interest rate to discourage over-reliance. They are sometimes regarded as a safety-valve mechanism for liquidity management. A central bank will normally expect/hope that the (net) day-to-day needs of the banking system will be met through either averaging of reserve requirements or through OMOs, where the central bank will normally operate only in one direction on a given day, and that standing facilities, over which it has much less control (at least in the short-term), and which can be used in both directions on the same day, should be used infrequently. In some cases, there may be additional, non-price mechanisms for restricting use. Access may be restricted to a percentage of the relevant bank's capital, or limited to, say, a maximum number of days consecutively. It may also be that normal access is determined by analysing the liquidity conditions prevailing in the market at the time and the spread between the rate charged on the facility and the market rate. Banks breaching these restrictions may be subject to additional supervisory requirements or, ultimately, to loss of authorisation (a bank which is over-reliant on central bank finance is, arguably, demonstrating an inability to fund itself in the market). Over-reliance on central bank intermediation can hamper the development of active secondary financial markets.

Exceptionally, a central bank may need to restrict or close access to standing facilities. In some countries where there has been speculation about an exchange rate devaluation, banks have used standing facility borrowing to fund purchases of foreign exchange from the central bank (effectively using the SF to fund speculation against the central bank's exchange rate target), betting that the speculative profits after the devaluation will more than offset the short-term interest rate costs of SF access.

xv: Broad categories of Standing Facilities

When a bank has a *temporary shortage* of reserves (i.e. is in need of liquidity), the central bank has a number of options as to how it might provide liquidity to the market through SF. It could:-

- provide a collateralised overnight loan;
- purchase outright short-dated securities, or foreign exchange;
- offer an overnight repo transaction where the central bank buys securities (with original maturities of any length) from the bank with an agreement for their resale at a specified price the following day;

- undertake an overnight foreign exchange swap; the central bank purchases foreign exchange from the bank against domestic currency with an agreement for resale at a specified price (exchange rate) the following day.

If a bank has a *temporary excess* of reserves, the central bank may:

- allow it to place overnight remunerated deposits with the central bank;
- sell foreign exchange outright;
- undertake reverse repos, the central bank selling securities with an agreement to buy them back at a specified price the following day;
- undertake an overnight foreign exchange swap; the central bank initially sells foreign currency and purchases domestic currency.

These options are exactly the same as for OMO (section 6.x), with the exception that it is very rare for a central bank to sell securities outright in a standing facility. The outright purchase (discounting) of short-term securities is more common, though less so than in the past. The differences lie in who takes the initiative and, reflecting this, in the pricing and the maturity.

xvi: Standing credit facilities

Virtually all central banks make available a standing credit facility. This normally takes the form of collateralised lending to the banking system at a margin above the central bank's main intervention rate; borrowers cannot bid for the rate. The penal rate of interest should act as an upper ceiling for market interest rates (at least for secured credit) at this maturity. These facilities – sometimes known as Lombard facilities (for historical rather than technical reasons) - are designed typically to provide short-term liquidity to banks on demand and are usually overnight. Sometimes the facility acts as an overdraft facility, by providing collateralised overnight funding to clear end-of-day imbalances – for instance if a commercial bank is unable to repay intraday credit provided for payment system purposes - and hence facilitate the smooth functioning of the payment system[50]. The marginal lending facility at the ECB[51] and the primary and secondary credit programmes in the U.S. are examples of these[52]. Some credit facilities are designed to provide longer-term collateralised funding on demand and at a pre-specified rate of interest.

[50] The collateral needs to be either readily available or deposited in advance at the central bank, the latter option allowing the central bank to appropriate it without the counterparty's further approval.
[51] The marginal lending and deposit facilities at the ECB are typically only used towards the end of the maintenance period; at other times, counterparties typically take advantage of the reserve requirement averaging facility as well as the weekly MROs to manage their liquidity.
[52] These U.S. programmes were established in January 2003 and replaced the discount window, which had provided liquidity at a rate below the FOMC's target for Federal funds (and latterly, despite the name, on a collateralised credit basis).

If there is no standing credit facility, or if its cost is too high, or if access is uncertain, then banks will tend to hold more funds in their free reserves as it may be cheaper to forego interest than to pay the SF rate on occasion. At times banks may not make payments on behalf of customers on the due date, although this may just pass the problem on to another bank.

xvii: Standing deposit facilities

Central banks could use a deposit facility to put a floor to market rates at the given maturity, and hence limit undue softness in interest rates. Deposit SFs have traditionally been less widely used than lending facilities; but they are available at the ECB and Bank of England[53]. When the central bank wants to manage liquidity primarily via OMO and reserve averaging (a pro-active approach to operations), these will typically be well below market rates – eg 100 basis points lower in the euro area[54]. To absorb market-wide surplus liquidity, pro-active central banks tend to use open market bill sales - often at market rates - to prevent market interest rates falling by more than is desired for monetary policy purposes. (Even in narrow corridor systems, the central bank may aim to set the rate far enough below the policy rate to give at least some room for an overnight interbank market to operate[55].) Some central banks will occasionally invite deposits from the banking system, but without offering a standing facility for them to do so. However, some central banks cannot forecast market liquidity with sufficient accuracy to operate a pro-active operational stance. In this case, in a situation of market-wide surplus liquidity, the deposit standing facility may effectively become the main policy instrument, and its rate could not by definition be below market rates (in Equation 1, section 2.b above, $Pr.SF_d$ will be high).

xviii: Symmetry or asymmetry in SFs?

The asymmetry in many developed countries between lending facilities (ubiquitous) and deposit facilities (less common) reflects (i) the fact that in most developed markets the banking system is persistently short of reserves and (ii) a need for standing credit facilities to reduce the risk of end-of-day payment system disruption (the payment system need for SFs is asymmetric). In addition, most central banks are reluctant to operate in both directions (i.e. to borrow from and lend to the banking system) on the same day, fearing that it could inhibit the development of the commercial money market; instead they prefer to meet only the banks' *net* requirements. Standing facilities for deposits and loans can operate simultaneously (these may be symmetric about the intervention rate but need not be), without the central bank effectively becoming an interbank broker, only if the rates used on both are sufficiently penal - high for borrowing

[53] The Bank of England's deposit facility was introduced in June 2001 in order to moderate any undue softness in overnight interest rates. It also complemented the existing overnight lending facility, by putting the Bank of England's overnight operations at the end of each day on a symmetrical basis.

[54] Some countries with an exchange rate target have used overnight deposit Standing Facilities at close to market rates, to support the exchange rate target.

[55] In Australia and New Zealand, by market convention banks tend to trade overnight funds at the official policy rate.

and low for deposits. This is the case at the ECB and Bank of England, where there are overnight interest rate corridors of 200bps and 50bp, respectively, centred around the central banks' respective intervention rates.

Particularly in a developing market, where counterparty creditworthiness may be difficult to assess, some banks prefer a low-yielding deposit with the central bank to a market rate from a counterparty of uncertain creditworthiness. As such, in emerging market economies (as opposed to more developed economies), standing facilities are likely, at least initially, to play a more prominent role than that of OMOs and inter-market trading. The depth of liquidity in the interbank market as well as how much progress has been made in liberalising market interest rates will also be key determining factors in how important standing facilities are for liquidity management. Hence, a central bank may find itself receiving large deposits from some banks and at the same time needing to re-finance other banks, effectively intermediating between the two groups and taking the credit risk on itself. As with developed economies, to counter this and promote a more active secondary financial market, the rates used on both facilities should be sufficiently penal so as to discourage banks from seeing the facilities as an easy alternative to the interbank market.

xix: Maturity of SFs and collateral positioning

Given the safety-valve nature of standing facilities, the maturity of the operation should be of a relatively short-term nature and the collateral should be easily accessible. This can include short-term loans (or deposits), repo (or reverse repo) or foreign exchange swaps, or the outright purchase (sale) by the central bank of short-term securities or of foreign exchange. In most countries, the maturity of SFs is overnight. This is suitable for the banking system: if rates are penal, banks will not want to lock into the penal rate for any longer than necessary.

The outright purchase (sale) of long-term securities would be less suitable as an SF mechanism.

If there is a restricted definition of suitable securities – e.g. type and maturity – this will increase the relative value of these securities to the banking system and so stimulate demand for them.

In some countries foreign exchange transactions may effectively operate as a standing facility. If the central bank always stands ready to deal in foreign exchange with the market - and this is most obviously true where a currency board or fixed peg is in operation - the market can always adjust its holdings of domestic currency reserves by entering into foreign exchange transactions with the central bank. Normally the central bank does not set a bid-offer spread to its exchange rate; but will often charge a small commission on banks using the facility.

But in the case of a managed or free float, the central bank could use foreign exchange in OMO transactions eg via an auction. It might not be possible then to use outright foreign exchange transactions for SF, but it may be possible to use swaps. For instance, if the central bank were to view the foreign currency as collateral, it could enter into an overnight foreign exchange swap, and charge the commercial bank a margin[56]. This differs to the normal pricing used for foreign exchange swaps.

The location of collateral is important for SFs, since the normal timing of the transactions – late in the business day – coupled with the need for same-day settlement means that there is little time to arrange the necessary back-office side of the transaction. If collateral is held in a registry managed by the central bank (this is often the case for treasury bills, or central bank bills if they are issued), or if the banks hold foreign currency deposits with the central bank, then it should be easy to arrange for the transfer of collateral. If the securities settlement system is not managed by the central bank, then there will need to be systems – both technical and administrative – to allow for rapid access to the collateral. This is not always the case, effectively blocking some assets for use in SFs. If collateral is held abroad – whether securities or foreign currency balances – there may be difficulties in ensuring sufficiently rapid access; and there may be timing problems eg if the collateral is held in a different time-zone.

[56] An interest rate margin for SF of 100bp annual would equate to 0.28bp a day (100/360). An overnight transaction for 1 mn currency units would cost the commercial bank 28 currency units.

8 REQUIRED AND VOLUNTARY RESERVES

Reserve requirements are the percentage of commercial banks'[57] liabilities (or some sub-set thereof) which they are required to hold as reserves at the central bank. An increase in reserve requirements forces the banks to hold more balances at the central bank, other things being equal. The banks have no discretion – except over time, by varying the structure of their balance sheets - and enforcement is usually through the central bank charging a penalty rate of interest for non-compliance, or more rarely, through non-price mechanisms such as limiting the transgressor's access to central bank facilities.

Historically, reserve requirements were regarded by some central banks as a prudential instrument - to ensure that banks had sufficient liquidity in case of withdrawal of deposits - rather than for monetary policy purposes. However, the importance of compulsory reserves as a prudential tool has lessened, at least in the more developed centres, because:

- The desire to reduce the element of compulsion implicit in reserve requirements has generally led to reductions in their levels to the point at which they cannot provide a very significant buffer of liquidity;

- With the development of financial markets, the range of other liquid assets available to commercial banks has increased markedly, including assets which the central bank may itself be willing to accept as collateral;

- The role of reserve requirements has widened, notably with the use of averaging, and therefore they are no longer optimally designed for prudential liquidity management, though of course they remain a liquid asset of the highest quality;

- Operations such as central bank standing facilities have overtaken reserve requirements as the mechanisms most appropriate for tackling liquidity issues. Indeed reserve requirements at high levels could even exacerbate bank liquidity problems by impounding banks' reserves and limiting the development of financial markets.

In some cases, reserve requirements were intended to put a wedge between deposit and lending rates, so that an increase in reserve requirements would discourage lending. However, this may just discourage

[57] Sometimes, the constituency subject to reserve requirements is greater than just banks e.g. in the euro area it is all credit institutions and in the U.K. it is banks and building societies.

banking sector intermediation in the economy. In some countries, reserve requirements have been set at high levels simply to offset excess liquidity in the economy. This may appear to be a cheap way of mopping up excess liquidity, but is detrimental to long-term economic and financial sector development.

Over and above any monetary policy role, reserve requirements provide income for the central bank, if they are either unremunerated or remunerated at less than market interest rates. The banks are compelled to deposit with the central bank at sub-market interest rates and, in turn, the central bank can invest the proceeds at market rates[58]. Any surplus income is normally paid across to the Ministry of Finance as part of the central bank's regular profits transfer, so to the extent there is surplus income, reserve requirements are acting as a tax raising mechanism. For many central banks (and Ministries of Finance), the income is an important reason why they prefer to maintain a system of unremunerated reserve requirements. However the cost to the economy of a high level of unremunerated reserves may well exceed any short-term income benefits for the authorities; they are clearly a wealth transfer rather than wealth creation mechanism, and high levels tend to inhibit financial sector development.

The Bank of England is planning to introduce reserve holdings on a voluntary basis as part of its planned money market reforms, to be introduced by mid-2006. These proposed reforms were first outlined in a public consultation document, published on 7 May 2004 with the results of this consultation published on 4 April 2005[59]. The new framework will include a move to averaging with voluntary, contractual and remunerated reserves, and is designed to help stabilise the overnight interest rate. The reserves are voluntary since no bank is obliged to hold them; contractual, since the amount so held must be agreed in advance; and remunerated at the policy rate. The new system will also allow more banks access to the Bank of England's operations, which should improve the banking system's ability to cope with stressed conditions.

Key questions for required reserves relate to the absolute level of requirements; whether reserves are remunerated or not; whether they can be averaged over a period around some particular level; and in what circumstances, if at all, the level should be changed. If reserve balances with the central bank are remunerated at or close to the policy rate, banks may hold voluntary reserves, or may agree a particular level on a bilateral contractual basis with the central bank (as with the system to be introduced by the Bank of England from 2006).

[58] If reserve requirements are being used to mop excess liquidity, the benefit to the central bank is that of opportunity cost: it should be cheaper – in the short-run – than market-based sterilisation instruments.
[59] Relevant documentation is available on the Bank of England's website under the 'Markets' section.

xx: Remuneration of reserves

Central banks are increasingly moving towards remuneration of reserve requirements, normally at the policy (short-term OMO) rate. In some cases this requires a change in legislation, as some central bank laws prohibit the payment of interest to depositors[60]. Where there is a market shortage of liquidity, the neutral cost of remuneration is the central bank's policy rate (ie the cost of funding the reserves is offset by the remuneration, so there is no net cost). But where there is a market surplus of liquidity, it is less obvious what the 'neutral' rate would be. The marginal cost for banks' liquidity might be zero (eg no interest paid on customers' current accounts). But the opportunity cost of holding required reserves might be the same as the central bank's policy rate, provided the central bank aims to drain surplus liquidity at this rate. An alternative would be the standing deposit facility rate (if there is one).

As noted above, if reserves are not, or not fully, remunerated they act as a tax on the banking system (and thus effectively on the customers of the banking system). Such taxes are distortionary. Remunerated required reserves with no averaging provision are broadly similar to a deposit auction; but are less precise and less market-friendly. The amount of liquidity drained will vary as banks' balance sheets change; and banks cannot trade required reserves (though in some countries they can pledge them as collateral).

Remunerated required reserves, where averaging is allowed, force banks to hold assets useful for liquidity management with only a small marginal cost to the banks. In this respect they are more useful than a deposit auction absorbing the same amount of liquidity at the same interest rate, since banks cannot use term deposits at the central bank to manage liquidity; and arguably more useful than issuance of central bank bills, since all banks have to hold required reserves whereas not all would buy auctioned bills. Moreover, while central bank bills (and other securities) can be used as collateral when accessing borrowing standing facilities, such facilities normally carry a penal rate of interest, whereas use of averaging involves no additional cost to the banks.

As noted above, if reserve balances are remunerated, the liquidity benefits of averaging will mean that banks will voluntarily hold reserve balances. Indeed, it may even be necessary to set a maximum level.

xxi: Short to medium term liquidity management

A change in reserve requirements - whether remunerated or not - is a relatively blunt instrument for managing liquidity in the banking system. It is generally regarded as cumbersome to change them often –

[60] Such prohibitions can make it harder for central banks to manage surplus liquidity, since they cannot hold deposit auctions.

few countries change them as often as once a year - or quickly. The use of OMOs to manage bank liquidity is a more appropriate fine-tuning instrument and is more likely to stimulate market development.

However, required or contractual reserves applied on *average* over a period, say a month, rather than on each day, may help to reduce the short-term volatility of overnight interest rates. Reserve averaging allows commercial banks to have automatic recourse to their cash balances with the central bank on a daily basis so long as the average level of reserves during the maintenance period at least equals the target level. This means that the banks do not need to achieve any prescribed level of reserve holdings at the end of every day, and it thus helps to reduce daily volatility in short-term interest rates which may otherwise be caused by, for instance, daily changes in the demand for cash by customers (the short-run demand curve for bank reserves becomes flatter). This stabilisation function can be achieved at any *level* of required or contractual reserves, including zero, and does not depend on whether they are remunerated.

In some countries - such as the U.S. and the euro area - the banks are allowed to go down to (but not below) zero on individual days. In the past, Canada and Mexico gave even more flexibility, allowing averaging around zero, provided that any negative balance was fully collateralised by acceptable securities. A number of central banks permit averaging but with less flexibility, for example by allowing banks to go a certain percentage below the target figure but no more. A country wishing to introduce averaging could adopt this last approach, gradually increasing the degree of freedom - say, 20% below the stipulated level on any day, and so on - and observing what effect this had on the banks' management of their reserves and on monetary conditions in general before relaxing further. For instance, if the average required level is 5%, a minimum end of day level could be set at 4%.

A bank should be able to maintain its actual average reserves very close to the target figure under an averaging system provided that (i) it has adequate systems to enable it to monitor and manage its liquidity; (ii) the scope for flexibility given by averaging exceeds the bank's need for operational reserves, and (iii) it has access to the interbank market or central bank facilities to offset any shortfall or excess. The last point implies that the central bank has a responsibility to provide the banking system with the appropriate level of liquidity over the maintenance period as a whole. If done, the introduction of an averaging system will therefore normally reduce the banking system's need for "free" (precautionary) reserves to close to zero, on *average*, effectively representing an injection of liquidity into the economy. Central banks must take account of this if introducing reserve averaging. If monetary conditions are to remain unchanged, their introduction should be accompanied by measures to withdraw liquidity, such as an increase in the *level* of reserve requirements, or open-market operations.

If the flexibility provided to the banking system by reserve averaging is sufficient to cover day-to-day

fluctuations in reserves, within-maintenance period interest rate volatility due to short-term or seasonal causes should be virtually eliminated. If the flexibility is not sufficient - perhaps because reserve requirements themselves are low, because only limited averaging is allowed or because averaging is not available to all banks - then averaging should help to reduce within-period seasonal volatility of interest rates but will not eliminate it. However, evidence suggests that overnight interest rates are likely to be more volatile on the last day of the reserve maintenance period. To mitigate this increased end-period interest rate volatility, some central banks allow a small proportion of the reserve requirement to be carried forward and met in the next maintenance period, while others use fine tuning operations.

It could be argued that reserve averaging can lead to poorer liquidity management as commercial banks take advantage of the increased flexibility averaging brings, and this may raise prudential issues. It could also be feared that, with commercial banks not needing to meet a binding reserve requirement on a daily basis, this may reduce market activity; and that a reduced need for trading will mean that banks will not need to test their creditworthiness in the market to such an extent, and this could also lead to prudential issues. On the other hand, banks could use the opportunity to take a more strategic approach to liquidity management, and so improve it. Indeed, a fear of having to resort to SF may discourage some banks from participating in the interbank market on a market-making basis; averaging, by easing the short-term liquidity constraint, may encourage participation. In practice, averaging is normally of benefit to the market.

xxii: The maintenance period

The central bank will have to decide on the most appropriate maintenance period e.g. it is two-weeks for the U.S. and one-month for the euro area. The length of the period will be a function of how active / passive a role the central bank wishes to have in terms of frequency of intervention in the market. The central bank should intervene at least once per maintenance period, for liquidity management purposes; at least once a week is normal. A few central banks operate, or have operated, a maintenance period of one week. But this is probably too short for banks to gain much benefit from averaging. Two weeks, or 4-5 weeks, is more common. It is also important to try and avoid days of increased liquidity uncertainty (e.g. tax payment dates) when determining the end-dates of the maintenance period.

For monetary policy purposes, there is a benefit to aligning the maintenance period ends with dates when monetary policy decisions are taken eg the MPC decision day in the UK, or the relevant Governing Council meeting in the ESCB. Provided operations at the policy rate do not span the end of the maintenance period, this can eliminate market speculation about future changes in interest rates leading to short-term rate volatility: averaging cannot then be used to arbitrage between official rates before and

after the policy meeting.

xxiii: Monetary policy purposes

Changes in the level of reserve requirements, irrespective of whether they are remunerated or not, can be used to affect the amount of banks' free reserves and short-term interest rates. For example, suppose a rise in the supply of reserve money is induced by higher unfunded government expenditure or lower tax receipts, or by central bank intervention to purchase foreign exchange. This will result in an increase in banks' free reserves at the central bank and a decline in short-term money market interest rates. Interbank interest rates and the banks' free reserves could be returned to their initial levels by the central bank increasing reserve requirements and thus the banks' demand for required reserves. (Similarly, reserve requirements could be reduced again once government expenditure declined or tax receipts increased, or foreign currency was sold by the central bank.) But reserve requirements are increasingly seen as a weak and rather blunt tool.

Reserve requirements remunerated at below market interest rates are a tax on financial intermediation. If the tax is sufficiently large, it is likely to result in disintermediation from the domestic banking system. Banks will try to hold more of their deposit liabilities in instruments not subject to reserve requirements. Therefore, even if higher reserve requirements - remunerated at below market interest rates - increase the effectiveness of controlling the *official* measure of the money supply, disintermediation is likely to mean that this measure is less relevant. This would imply a weakening in the relationship between the targeted measure of the money supply, on the one hand, and prices and real output on the other.

Moreover, banks would be expected to increase the spread between deposit and lending rates offered to customers if reserves are not fully remunerated: the central bank would be passing the cost of the liquidity withdrawal onto the banks' customers, with consequent changes in their behaviour.

Therefore the active use of reserve requirement levels as a monetary policy instrument in most developed countries has disappeared and they now tend to be kept at low and stable levels. However requirements tend not to be eliminated altogether due to the resulting impact on the market's liquidity position. In addition central banks are keen to retain the smoothing influence on short term interest rates that reserve averaging brings, with many providing remuneration to minimise (though not necessarily eliminate[61]) the tax impact of imposing requirements - e.g. the ECB remunerates reserves at the average of the marginal interest rates of the Main Refinancing Operations (MROs) over the maintenance period. But for monetary policy purposes, central banks prefer to use more market-orientated mechanisms such as OMO and SF.

[61] Banks have to hold assets to meet the reserve requirement and these tend to be lower yielding than the banks would prefer.

xxiv: General issues about reserve requirements

Reserve requirements are typically based on a proportion of an institution's deposit liabilities known as the "reserve requirement base". There are a number of issues that the central bank needs to consider when deciding on the definition of this base.

- What is the objective of the reserve requirement? For example, if it is to ensure the effective control over broad money for monetary policy purposes, then the definition of the deposit base should be as similar as possible to the desired target measure of the broad money supply (assuming a money supply target is used). If the deposit base is defined more narrowly / widely than the target, then control could be impaired as they may operate independently. If reserve requirements are designed for alternative reasons such as to raise income or to provide a liquidity buffer, then the deposit base may differ from that which would be included for achieving a monetary target e.g. for a liquidity buffer requirement, the base should consider the range of liabilities which can be the source of involuntary cash outflows.
- Reserve requirements should not be applied to interbank deposits, since this would act as a double tax on banks - they would be taxed on raising deposits from non-banks and then again when monies were re-deposited at other banks - and would inhibit the development of an inter-bank market.

- Reserve requirements should be applied equally, as far as possible, to all banks and all types of deposit[62], for reasons of equity, ease of calculation and monitoring and because a multi-tier reserve requirement would weaken the central bank's monetary control - for example, a shift in deposits between banks or between types of deposit which were subject to different reserve requirements might alter the aggregate reserve ratio and thus overall monetary conditions, independently of any action intended by the central bank. Indeed having a multi-tier reserve requirement would actively encourage banks to adjust their liability portfolios into products of lower / zero reserve weights.

- Reserve requirements should be applied equally to domestic and foreign currency liabilities, although there is some debate on whether reserve requirements imposed on foreign currency liabilities should be met in domestic or foreign currency (the former imposing a foreign exchange mismatch on the banks' books).

[62] This may, however, be difficult in the early stage of reform if excess reserves are unevenly distributed across the financial system. In practice, and for prudential reasons, reserve requirements in many countries are levied at a higher rate on sight than on time deposits.

- There should be a lag between the calculation period and the holding period for the reserves, otherwise the reserve requirement will be a function of the banks' liabilities during the maintenance period, which will be uncertain until the end of the period.

When considering what assets should be eligible to be counted towards reserve requirements, deposits with the central bank are always included. More debatable is the treatment of vault cash i.e. that which is in the vaults of the commercial bank. Some central banks include vault cash as part of the eligible assets that count towards reserve requirements because of the transport costs and security issues of excluding it. Others exclude it on the basis that it can lead to a rising proportion of damaged / soiled banknotes in circulation as the central bank's ability to inspect notes is lessened, or because inclusion can encourage inefficient cash management by banks. How frequently data on cash holdings is reported will have an impact: if there is a substantial lag, it may be difficult for the central bank to know accurately the actual level of reserve holdings until some time after the end of the maintenance period, and difficult therefore to manage liquidity accurately. One possibility would be to count vault cash towards reserves, but with a lag of, say, one month. Then the central bank would know at the start of the reserve maintenance period exactly how much vault cash was to be included for that period.

For remuneration purposes, there is a case for remunerating only balances at the central bank, but not vault cash, in part to encourage efficient cash handling. But some central banks would remunerate both, as both constitute a central bank liability. Exclusion could penalise regional banks, or those with a branch network in rural areas, as it may be harder/more expensive for them to return surplus cash to the central bank.

Also, assets eligible to be counted towards meeting reserve requirements should not include government securities or any other OMO eligible instruments. Otherwise OMOs would be less effective to the extent that banks could purchase such securities, when sold by the central bank, with their cash held for meeting the reserve requirement (as the securities would act as the substitute in meeting the requirement), thereby leaving their free reserves unaffected and hence negating the impact of the OMO. The inclusion of these securities towards meeting reserve requirements would also hinder the development of a liquid secondary market in them.

9 COUNTERPARTIES

When the central bank starts to use market-based instruments, and particularly OMOs, it needs to consider whether it should deal with all banks, or with just a small range of counterparties. To some extent this is an administrative issue. If central bank OMOs are infrequent, perhaps once a week, and the banking system has some scope for day-to-day (fine-tuning) liquidity management via reserve averaging or standing facilities, then the OMOs could easily involve all banks, and possibly even non-bank financial companies such as securities firms[63]. The operation may take longer, because of the need to process bids from a potentially large number of counterparties, than if the central bank dealt only with a restricted group. But for infrequent operations this may not be important. On the other hand, if the central bank conducts OMOs every day, or several times a day, it may well prove too cumbersome a process to deal with all registered banks. A desire to improve the speed and accuracy of the bidding process may justify a move away from a telephone based dealing system to a potentially more costly electronic system. Central banks who do adopt an electronic dealing system will however need to take care to continue cultivating a dialogue with their counterparties. This dialogue provides an opportunity for the central bank's dealers to discuss market conditions and gain market intelligence. It can allow the central bank to evaluate how efficient its monetary operations are, how effectively it is communicating its monetary policy and, what the market's expectations are for the future. It can also draw the central bank's attention to certain areas of risk in the financial system that may have otherwise gone unnoticed for a longer period of time.

Many countries choose to conduct OMOs with a smaller group of intermediaries such as the primary dealers in the U.S. However, the ECB chose to conduct its MROs (as well as that of its longer-term operations and access to standing facilities) with all credit institutions in the 'Euro' area (i.e. all those subject to Reserve Requirements), subject to certain minimum conditions (e.g. counterparties must be financially sound and fulfil operational criteria to ensure the efficient conduct of the monetary operation). This is potentially several thousand institutions; in practise, a few hundred. The operations are decentralised; each credit institution deals with its national central bank, having signed a legal agreement before so doing. All decisions on tenders (amount, allocation etc) are taken by the ECB. Bids are submitted on the day of the tender, with the results published the same day and settlement made the following day. However for some operations (e.g. quick tenders, used at the end of maintenance periods if market rates move too far from the MRO rate) each national central bank selects a sub-group of counterparties from those that fulfil the general eligibility criteria. This selection centres on the counterparty's activity in the money market, efficiency of the trading desk and bidding potential. When

[63] Most of the Fed's primary dealer counterparties are the securities firm subsidiaries of banking groups.

foreign exchange swaps are used in monetary operations, the range of eligible counterparties corresponds to those selected for the Eurosystem's foreign exchange intervention operations.

If there is to be a smaller number of counterparties, the selection will partly depend on what function they are expected to perform. If they are expected to distribute liquidity throughout the system, they will need to have the systems and interbank relationships to do so. Or they could be asked to take on other obligations in return for the dealing relationship with the central bank - such as making a market in short-term funds. If banks are allowed to be OMO counterparties simply in order to help them manage their own liquidity, the selection may be simpler. The central bank could simply choose a group of the largest banks in the country (defined by paid-up capital, or balance sheet size either at a particular date or averaged over a period), perhaps revising the list once a year. At the margin this might encourage some banks to boost their balance sheet in order to be included in this group; some flexibility in the number chosen – i.e. "around 50 of the largest banks" - might help to avoid this, though it could also give rise to charges of favouritism. Another possibility would be to use a group of specialist market-making intermediaries, which did not engage in general banking business. Perhaps, the choice of counterparties should just encompass those banks that settle their accounts over the books of the central bank.

In deciding the particular function for the counterparties to perform, the central bank should remember that counterparties are typically profit-maximising private sector firms. For a counterparty to want to enter into a dealing relationship with the central bank (and remain with that status), any obligations from dealing will need to be balanced by some equivalent benefits. Typically counterparties will have to deal with the central bank on a regular basis, and this may involve dealing at a time which does not suit their trading book e.g. the central bank providing liquidity to a net short market, but with the counterparty long of funds. As much as possible, the central bank should keep the definition of "regular" fairly relaxed e.g. in terms of size and frequency. The analysis of the counterparty's performance[64] could be over a period of weeks rather than on a daily basis so as to allow for flexibility (e.g. to take account of fluctuations in the counterparty's staffing arrangements). Other obligations may involve central banks' charging more than private market players for allowing access to central bank liquidity. The charge may be in the form of an initial margin (haircut).

Set against these obligations, the counterparty must weigh up the benefits of having access to central bank liquidity (and where deposit facilities are available, an outlet for excess funds), having the ability to open

[64] Performance measurements could include frequency and size of dealing with the central bank (absolute and in relation to their primary or secondary market share of the instruments traded), analysis of liquidity distribution (e.g. via the analysis of the spread between the policy rate and market rates) and through qualitative assessment of market intelligence.

a dialogue with the central bank about the conduct of the financial markets[65]. Indeed the central bank should also be comfortable with the credit risk exposure of dealing with its chosen counterparties. This may involve the central bank imposing a minimum acceptable credit rating in the selection criteria[66]. Others though prefer a less formal approach, suggesting that the counterparties must only be subject to appropriate prudential supervision and drawing comfort from criteria that push selection towards those that have an active presence in the relevant markets. The choice of repo as the cornerstone of many central banks' transactions with their counterparties is also partly driven by the credit risk protection that this instrument affords the cash lender.

Whatever criteria are used in the choice of counterparties, it is important that any such group of intermediaries is large enough for competition to exist between them. In some cases, it may be that the central bank may have to impose certain dealing restrictions (e.g. maximum allocation limits based on the stock of refinancing outstanding) in order to ensure a level playing field and sufficient competition[67].

The central bank can also distinguish between different groups for different functions. For instance, the Bank of England's new system distinguishes between OMO counterparties and Settlement Banks (those playing a major role in the payment system). OMO counterparties do not need to be banks and do not need access to Standing Facilities. Those banks playing a role in the payment system will need access to Standing Facilities, but do not need to be OMO counterparties. (In practice, of course, there will be a large degree of overlap.) The table below, from the Bank of England's April 2005 publication "Reform of the Bank of England's Operations in the Sterling Money Markets" indicates the relationship between the functions and the counterparty groups. 'Reserve-scheme member' refers to any bank which chooses to hold voluntary, contractual reserves with the Bank of England. Settlement banks must be reserve scheme members, but reserve scheme members are not required to become settlement banks.

[65] The Bank of England does not publish a list of its counterparties. The US Fed does publish, but notes that " this list has been compiled and made available for statistical purposes only and has no significance with respect to other relationships between dealers and the Federal Reserve Bank of New York."

[66] Due to the importance of conducting effective monetary operations in order to achieve the desired monetary policy, the legal agreement used, while perhaps based on a standard market agreement, may be tailored so that it is set up in favour of the central bank.

[67] A related topic is covered in more detail in *Handbook No.6,* "Primary dealers in government securities markets".

Access to Bank Facilities

If wanting access to → Required also to have access to ↓	Standing facilities	OMO counterparty	Reserve-scheme member	Settlement Bank
Standing facilities	n/a	No	Yes (Same legal entity)	Yes (Same legal entity)
OMO counterparty	No	n/a	No — although likely to find it useful. (Can be different legal entity within the group provided the OMO counterparty is an authorised bank, building society or dealer.)	No — although likely to find it useful. (Can be different legal entity within the group provided the OMO counterparty is an authorised bank building society or dealer.)
Reserve-scheme member	No	No	n/a	Yes (Same legal entity)
Settlement Bank	No	No	Not a requirement (although the Bank would welcome membership)	n/a

10 STRUCTURES OF MONETARY POLICY INSTRUMENTS

Most central banks in developed countries use a combination of OMOs, standing facilities and reserve requirements for managing liquidity and achieving their monetary policy objectives. The appropriate balance between them will depend on the structure of local financial markets, and the way in which the central bank wishes to manage the market. As the market develops, and in particular as a central bank's ability to forecast liquidity flows strengthens, OMOs are likely to play a more prominent role than standing facilities.

Amongst major developed country central banks, some target the overnight interbank rate (Australia, Canada, New Zealand, US); this may be referred to variously as the '(Official) Cash Rate' or 'Federal Funds Rate'. The UK, following the Sterling Money Market Reforms, will seek to ensure that the overnight rates[68] out to the next MPC meeting date are consistent with the MPC official rate. The ECB does not specify a target, but aims for the overnight rate out to at least two weeks to be in line with its Main Refinancing Minimum Bid Rate.

Many central banks deal directly only with a small group, maybe 20, of specialist money market counterparties (which do not need to be banks). The ECB deals potentially with all credit institutions in the euro area, but in practice with 200-300. In developing countries it is common to allow all banks to participate; and it does not always make sense to introduce a market-maker function, especially if rates are too volatile, or money markets too underdeveloped, for such a role to be undertaken without substantial risk.

A number of developed country central banks (Australia, Canada, New Zealand, USA) conduct OMO on a daily basis, though the ECB operates only weekly, and the Bank of England will also operate weekly following the introduction of the new system in 2006. Countries which do not have required reserves, or do not allow for reserve averaging, have to operate on a daily basis in order to manage market liquidity (though reserve averaging does not preclude daily operations, as in the US). Many developing market central banks conduct OMO only once a week, leaving liquidity management between operations to reserve averaging and SFs.

The use of repo is predominant, with central banks attracted by its flexibility and legal protection. Repo can be used either to provide or absorb liquidity and can be accommodated within a variety of auction

[68] Notably the uncollateralized interbank rate and the interbank repo rate; and SONIA (the weighted average of actual overnight transactions conducted via the brokers).

systems (e.g. fixed or variable rate); it is self-liquidating, making it ideal for operations designed to temporarily adjust the market's liquidity position; and the fact that the transaction unwinds means it does not impact on the price of the underlying security. The same flexibility can be achieved with collateralised lending (to supply liquidity) and the sale of short-term central bank bills (to drain liquidity). But repo typically offers stronger legal protection than collateralised lending: if properly documented, it affords the lender of cash legal ownership of the underlying security for the duration of the trade. This means that if a counterparty were to default, the central bank (as lender) could sell those securities in the secondary market in order to try and recoup its lost money. In general, the G7 countries make little regular use of outright transactions.

In many if not most developing markets, the central bank faces a surplus of liquidity, and needs to operate to drain liquidity rather than lending to the banks. In a number of countries, the central bank takes remunerated deposits, or sells short-term securities, at a range of different maturities; repo is not commonly used to drain liquidity (not least since many central banks lack a portfolio of suitable securities). If more than one maturity is used, it is advisable to have a clear idea of the reason for the use of different maturities: too many, especially if the central bank determines the rate, may confuse the signal which the central bank sends to the market. Where foreign exchange is used as an OMO tool, this nearly always takes the form of outright transactions. Foreign exchange swaps could be used if the central bank was concerned only about liquidity management; but as exchange rate management is normally also important, outrights make sense.

Particularly in developed markets, central banks undertake liquidity forecasts to allow them to use OMO and reserve averaging as the prime tools of liquidity management. It is then normal for standing facilities to be subject to penal interest rates (being set at a margin above/below the policy rate) in order to encourage use of OMO and the interbank market. The U.S. moved to this model of penalty interest rates in 2003. The spread between SF rates and the policy rate will reflect a range of issues: the depth and liquidity of the market (25bp might be sufficient incentive in one market, but be negligible in another); whether or not there is an exchange rate target; how tightly the central bank wishes to steer market rates; the quality of the liquidity forecast and perhaps whether the central bank is usually draining or supplying liquidity.

In the euro area, Reserve Requirements are remunerated at the average of the marginal interest rates in the MROs over the maintenance period, so that the implicit taxation is minimised. The reasons for the imposition of reserve requirements at the ECB are to allow averaging and to increase the size of the structural shortage of liquidity in the market. In the US, reserve requirements are averaged but not remunerated; in Australia there is no reserve requirement as such, but banks hold voluntary reserve

balances which are remunerated at 25bp below the policy rate, and which operate in some respects as remunerated reserves with averaging. The UK will introduce remunerated contractual reserves from 2006.

11 CONCLUSIONS

There is no single ideal structure of either monetary policy targets or money market operations. These structures will vary from country to country, depending on size, structure of financial markets, history and so on; and for any one country the optimal targets and structure may change over time. That said, certain issues are common to most countries; and the fact that in some cases the same, or similar, solutions are adopted by a clear majority may indicate that those solutions are in some way better than the other possibilities[69].

Some central banks use interest rates as their operational lever. In some cases this is complemented by an *intermediate* target, which may be for the exchange rate or some other variable, such as the quantity of money. The *final* policy target is typically for inflation. Others use the exchange rate as an operational lever, whether with a fixed target or a managed float. The choice may reflect the level of market development, and of effectiveness: in many developing markets, the interest-rate lever is weak. Interest-rate levers may be used in support of an exchange rate intermediate target. Foreign exchange operations could be used as part of the central bank's liquidity management, in order to reduce volatility in short-term interest rates.

A distinction may be drawn between shorter-term and longer-term goals. On a day-to-day basis central banks usually aim to keep market interest rates or the exchange rate relatively steady, close to a target level. But the target level of interest rates is changed periodically, consistent with the broader monetary policy targets for the exchange rate, monetary growth or inflation; and exchange rate targets are also subject to revision.

Liquidity management is a key part of monetary operations. Even if the central bank has no interest rate policy, it makes sense to have a structure of operations which will allow for efficient management of liquidity, and so prevent short-term interest rate volatility occurring purely as a result of short-term liquidity flows which carry no economic information. Reserve averaging is a key tool here, ideally complemented by a good liquidity forecast. In the absence of a good liquidity forecast, SFs have to take on a more significant liquidity management role.

In some countries, the banking sector is normally short of liquidity. This then forces the banking system to borrow from the central bank, so that the central bank can enforce its desired level of interest rates. The central bank is liquidity provider of last resort, and can use its monopoly strongly. But in the

[69] Although it may instead indicate that, to some extent, even monetary policy makers like to go with the crowd.

majority of countries, the banking sector has surplus liquidity. It can place the excess with the central bank and the central bank then determines the interest rate at which it withdraws liquidity from the commercial banks. But this is not seen to 'bite' so much on the banks. If the banking system is short, it has no choice but to participate in OMOs or SFs to borrow; but if it is long, it could in principle choose not to participate in offsetting OMOs, particularly term interest-rate based OMOs, or in SFs with a maturity longer than overnight. For instance, there have been occasions of banks holding the excess liquidity on a settlement account at the central bank rather than engaging in OMOs, preferring to maintain liquidity and thus the option to switch funds into foreign exchange at short notice[70].

Those operations where the central bank can easily determine the maturity, and which have minimal spill over effect beyond the short-term money markets, are normally preferable. These would include repo, collateralised lending and foreign exchange swaps. There are different risks - financial and legal - involved in each; but because they are all reversed (within a period which may be much shorter than the remaining life of the underlying asset), they do not have the same effect on the securities or foreign exchange markets as outright transactions. They are preferable, therefore, for monetary policy operations, whereas *outright* transactions in government securities or foreign exchange are more useful when the central bank or government want to alter their debt management or exchange rate policies.

There is a great merit to simplicity. Those using an exchange rate lever operate periodically – whether daily or weekly – in the outright foreign exchange market. This is straightforward, though the impact may be weakened if the central bank operates in bilateral outright foreign exchange operations at times other than in its regular OMO. Many central banks using interest-rate levers operate with a policy rate, normally though not always for a short-term maturity (up to two weeks); and overnight standing facilities at a margin above and below the policy rate. While a number of central banks set different interest rates for different maturity operations, this often confuses the policy signal and can discourage money market development.

Market-based instruments may appear to be more risky, or less certain, than administrative measures such as direct controls on credit extension because their impact on the banking system, and on the wider economy, cannot be precisely determined in advance, especially if there is no track-record of their use. But it is important to distinguish between direct controls whose effect on statistics may be clear but whose effect on the real economy is less clear and likely to weaken over time, and which obstruct market evolution; and indirect instruments, which cannot be administratively evaded and whose effect encourages both efficient behaviour by the banking system and development of financial markets.

[70] Further details can be found in the CCBS Lecture Series #3: "Surplus Liquidity: Implications for Central Banks" (Joe Ganley) which can be found at www.bankofengland.co.uk/education/ccbs/handbooks_lectures.htm

Central banks in developed markets find that market-based instruments are, in most circumstances, more flexible and more efficient for the wider economy.

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APPENDIX 1: RESERVE MONEY TARGETING

If the central bank were to fix the month by month path of reserve money *(M0)* and take the view that this will have a predictable influence on the broad money supply *(BM)*[71], this would require that the ratio of broad money to reserve money - the money multiplier *(m)* - is stable, or at least predictable. Broad money is defined by $BM = C+D$, where C is domestic currency in circulation and D is deposits with commercial banks; reserve money is defined by $M0 = C+R$, where R is central bank liabilities held by commercial banks (required reserves plus free reserves and vault cash). Then,

$$m = \frac{BM}{M0} = \left(\frac{C+D}{C+R}\right) = \left(\frac{(C/D)+1}{(C/D)+(R/D)}\right)$$

If the ratio of the banks' reserves at the central bank to their own deposit liabilities *(R/D)* and the ratio of currency issued to their deposits *(C/D)* are constant, then any increase in the supply of reserve money will be reflected in a fixed multiple expansion of broad money *(BM)* as banks expand their balance sheets to use the additional headroom, and the money multiplier will be constant in the medium term.

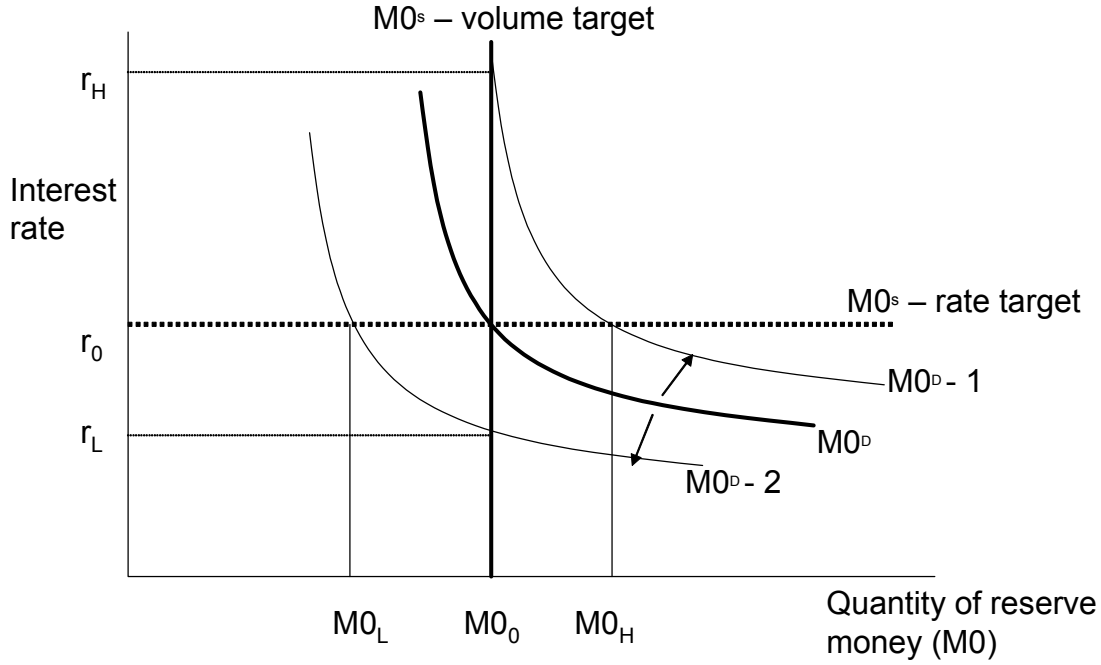
In practice, these ratios, as well as the ratio of nominal income to broad money (the velocity of money), are often not very stable or even predictable, particularly during periods of financial liberalisation or rapid changes in inflation. This means that a specific quantity of reserve money could be consistent with a range of outcomes for the broad money supply, inflation and real output. Most central banks use a monetary aggregate as a monitoring variable rather than as a target. That said, it may well be that, where monetary financing or capital inflows are major factors driving narrow money growth (ie it is supply- rather than demand-driven), the relationship between narrow money growth and inflation may be stronger and hence sterilising action by the central bank more appropriate.

In the chart below, if the central bank wants to stabilise interest rates at r_0 (its policy rate), then it will inject or absorb liquidity as necessary to do this: this is a liquidity management function. The supply curve will be horizontal, and a move from $M0^D$ to $M0^D$-1 or $M0^D$-2 does not affect rates. By contrast, if it wishes to hold the path of reserve money growth on a given course – imperfectly represented by the vertical line supply curve in the chart – then it will have to accept the change in interest rates to which this will lead, for a given change in demand. For example, a demand shift from $M0^D$ to $M0^D$-1 will lead to interest rates rising, over time, to r_H. If there is a shift in supply – e.g. if the supply curve shifts to the right (to MO_H on the graph) because of an increase in net lending to the government or net foreign exchange

[71] If the velocity of broad money is predictable, changes in the quantity of broad money will, in turn, affect prices and real output in a predictable manner.

reserves, then in both cases – stabilising interest rates or the path of reserve money – the central bank will need to take offsetting action to move the supply curve back.

Longer-run demand curve is interest-rate elastic: central bank can target rate or volume



APPENDIX 2: SECURITIES USED IN MARKET-BASED OPERATIONS

If securities other than those of the domestic government are accepted as collateral, or bought outright or on repo, the central bank needs to be able to satisfy itself about the credit risk involved. This will involve restrictions on acceptability, such as a minimum credit rating of the issuer, and in the case of some issuers a maximum for original maturity and perhaps a lower maximum for residual maturity. There may also be a maximum exposure limit to some issuers.

A certificate of deposit (CD) issued by a bank would not provide any additional security in lending to that bank, though a CD issued by bank A might perhaps be used as collateral in lending to bank B. Similarly, a commercial bill issued by a company and drawn on (and guaranteed by) a bank with which it had very close links might represent poor collateral when lending to that bank. But a commercial bill drawn on bank A and endorsed (guaranteed) by bank B might be used as collateral in lending to bank B. In other words, the central bank needs to ensure that collateral provided does actually reduce its exposure to credit risk to within acceptable limits.

Where securities are accepted as collateral or used in repo transactions, the central bank should consider taking (but not giving) margin. For instance, if a bank wishes to borrow 100, it might be required to provide securities with a current market value of 105 (the additional 5 represents the 'initial margin' or 'haircut'). In developed markets the borrower is normally required to maintain the margin on a daily basis, subject to a materiality threshold known as the 'call trigger' amount. If the secondary market value of the securities in question falls, more must be provided; and if it rises, some may be withdrawn (the amount that moves is known as 'variation margin'). If margin is maintained daily, then the lender is exposed to risk of loss only if the market price of the securities falls by more than 5% (or however large the initial margin is) during the day.

If some securities involve the central bank in more work or expense, it is reasonable for the central bank to charge these costs to the borrower.

The location of settlement may also be important, if securities which are settled in other countries are accepted. In this case, the central bank will need to consider different jurisdictional issues, ease and cost of access, and business hours.

APPENDIX 3: SIZE OF OPERATIONS

Under a fixed rate tender[72], if the central bank injects or withdraws liquidity for a week, or a month, then at the same time it sets or at least influences the marginal interest rate for that period. The discussion on setting official rates suggested that central banks have the most influence through their market operations on short-term rates, and this implies that the maturity of the central bank's operations should also be short-term[73]. If the weighted average maturity of the central bank's stock of lending to the banking sector is, say, two weeks (10 working days), then this stock will be ten times the size of its average daily operations, or twice the size of its average weekly operations. Does the size of the stock and/or flows matter? And will the banking system be affected by its net or its gross position vis-à-vis the central bank? In terms of direction, whilst most central banks would prefer to operate with the market in a structural deficit (i.e. lending to the market), many operate in an environment of surplus liquidity in the market and yet still have influence over market rates (although there are balance sheet cost implications).

Some argue that the size of the stock and flows does not matter: it is sufficient that the central bank is the marginal provider of liquidity to the banking sector for it to be able to control interest rates at the maturity at which it intervenes. That argument assumes, however, that markets work perfectly and that economic agents respond predictably and immediately to the smallest shifts in their marginal costs or revenues. It may also assume that there is only one marginal provider of liquidity. It is more likely in practice that the size of the stock *does* matter. In a market system, the central bank's OMO rate has an influence only if the banking sector needs, or expects that it may need, to borrow (or perhaps deposit surplus cash) at that rate. Furthermore, only if banks have (or anticipate the need) to conduct *substantial* volumes of transactions (in relation to the size of their balance sheets) at the central bank's rate, will changes in that rate be likely to have a very close short-term influence on the banks' own interest rate structures. However, the precise relationship between the size of the central bank's activities in this area and the influence over market rates is a matter of debate.

For a given stock of central bank lending to the banking sector, the longer the average maturity of the central bank's operations, the smaller will be their average daily scale. The central bank may have preferences over the size of these daily operations: does it want an active or more passive role in daily market activity?

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[72] Or indeed even if it is a variable rate tender regime with the central bank enforcing a minimum bid rate (e.g. ECB MROs).

[73] The maturity of the central bank's operations will also be a function of the desired liquidity profile in the banking system. A central bank concerned about a structural surplus in its money market could issue debt in its own name (central bank bills) for a maturity substantially longer than the maturity at which it conducts OMOs so as to reduce or eliminate the surplus. However, in this case the central bank would need to understand the effect on its balance sheet; and the central bank would normally be a rate taker in longer-maturity operations.

The size of daily flows may also need to be considered for payment and settlement capacity considerations. Some central banks effectively split their liquidity management operations, using short-term operations to implement policy, but putting part of their transactions with the commercial banks onto a longer-maturity basis at a market rate. One reason for this is to prevent potential problems in back-office management of very large volume transactions from interfering with the monetary policy signal.

The frequency of the monetary policy meetings should also be considered when deciding on the maturity of the operations: there is the potential for current policy operations to become entangled with expectations over future policy. For this reason, central banks with a pre-announced calendar of monetary policy decision meetings may ensure that OMOs do not straddle the dates on which a decision is made e.g. the ECB and, after the current reforms, the U.K. An alternative approach is to operate very short-term, such that the weighted average of any OMO lending which straddles a decision date is very small in relation to the total of OMO lending.

APPENDIX 4: DECENTRALISATION

In most countries there is just one financial centre, and banks or financial companies which wish to be involved in the heart of the banking system will have an office, if not their head office, in that centre. Frequently the banks and other financial institutions are closely grouped around the central bank and the exchanges, as, prior to widespread use of electronic means of communication, physical proximity was necessary for easy and rapid communications and settlement of transactions. The City of London (the "Square Mile") is a prime example of such centralisation.

But in some countries - such as the U.S. and Russia or the euro area - there may be several financial centres, possibly spanning a number of different time zones. This multiplicity of centres can give rise to two problems: first, how does the financial system as a whole, and the central bank in particular, cope with operations in different time zones - particularly if, as for example in Russia, there is a large span and in some cases little or no overlap in business hours? Second, if the central bank is to operate in a number of different centres, how can it ensure co-ordination of its actions without slowing down its operations unduly? Of course, the advances in communications technology of the late 20th and early 21st Centuries have meant that pressure for geographical centralisation has generally decreased.

A key issue in any market is to adopt a clear and consistent policy to define the end of a business day. For some purposes this may need to be universal - for instance, the operating hours and booking policy of a nationwide payment or settlement system. And some contracts may need to specify which time zone is being used - e.g. "payment to be received by 3:00pm London time". For others, it would be on a bank-by-bank basis - for instance, a bank may define the end of the day, for its own ledger purposes, at a particular time each evening, perhaps when electronic data is downloaded for overnight batch processing. In any case, the settlement date of a transaction is likely to be more critical than the transaction date.

For other purposes, the central bank and the financial markets could accept an inequality between different regions. Same-day settlement for large-value transfers might be available in one major centre only, on the grounds that those companies for which this is important are likely to have an office in the financial capital, and the value-added in providing such a system nationwide may not justify the costs involved.

The second issue, that of co-ordination and consistency of the central bank's own operations, rests importantly on whether it is merely the transactions, or also the decisions, which might be de-

centralised. This in turn may depend on the political balance in the country between federalism/regionalism and centralisation. But in any case it may make sense for commercial banks to be permitted to deal only with the head office or a nominated branch of the central bank; or for the head office only of the commercial bank to deal with the central bank. This should prevent possible confusion if, for instance, several branches of the commercial bank entered into transactions with different branches of the central bank.

With OMOs, where the central bank takes the initiative, decisions must be taken centrally. If implementation is to be decentralised, the OMO division of the central bank will need to have in place the necessary systems to allow quick communication with its branches in order to minimise the time delay between taking decisions and implementing them. For example, the ECB follows a policy of centralisation for the co-ordination of OMOs: the liquidity allotment decision is made by the ECB. But the transactions are conducted on a decentralised basis between the National Central Banks (e.g. the Banque de France and the Bundesbank) and their counterparties. The need to minimise the time delay between the centralised decision and the decentralised implementation is countered, to some extent, by the fact that these operations are settled on a T+1 basis. Nevertheless it is still important for counterparties to know the results quickly (ideally within 30 minutes or so) after the OMO, even if settlement is delayed.

As use of standing facilities is at the banks' initiative, and to the extent it is for small amounts, it can be handled on a decentralised basis. This is effectively what happens in the US, and in the euro area. If a bank's reserve requirements and access to intraday credit (for payment system purposes) are maintained in a single account, the central bank's monitoring task is easier. If the commercial banks maintain accounts at different branches of the central bank but these are not consolidated daily, the central bank may need rapid reporting to the centre of the use of standing facilities so that it can monitor the total (and perhaps limit its exposure to particular types of collateral).

There may be times when liquidity in the banking sector does not appear to be flowing easily from one region to another, resulting in different interest rates across the country and thus, on the face of it, an uneven monetary policy. The central bank will then need to distinguish between problems caused by inadequate financial infrastructure, where it may therefore legitimately play a role in facilitating liquidity transfers (for instance by lending in one region rather than another); and, on the other hand, differences caused by poor credit-worthiness, or inefficient or uncompetitive behaviour by banks in a particular region. In the latter case the central bank should leave market mechanisms to resolve the problem; or perhaps play a temporary, catalytic role, providing it can avoid taking on excessive risk itself.

If the central bank is prepared to accept commercial bills as well as government securities in its money-market operations then, depending on how such bills are defined, it may be necessary to use the branch network of the central bank in checking the eligibility of bills issued by companies in a branch's locality (or, in case of default by the borrowing bank, for presentation to the commercial company for payment). Here the decision in favour of decentralisation would depend not on whether to provide liquidity, but on whether to accept a particular bill as collateral in a given operation.

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Woodford, Michael (2001): "Monetary Policy in the Information Economy" http://www.kansascityfed.org/PUBLICAT/SYMPOS/2001/sym01prg.htm

Useful Websites

Bank of England	www.bankofengland.co.uk
U.K. Debt Management Office	www.dmo.gov.uk
European Central Bank	www.ecb.int
Federal Reserve Bank of New York	www.newyorkfed.org
Bank for International Settlements	www.bis.org
International Monetary Fund	www.imf.org
List of central banks	www.bis.org/cbanks.htm

CCBS HANDBOOKS

The text of all CCBS handbooks can be downloaded from our website at
www.bankofengland.co.uk/education/ccbs/handbooks_lectures.htm

*These **Handbooks** are also available in Russian, Spanish and Arabic – see annotations (R) (S) (A) .*

Handbooks in Central Banking

No	Title	Author
1	Introduction to monetary policy (R) (S)	Glenn Hoggarth
2	The choice of exchange rate regime (R) (S)	Tony Latter
3	Economic analysis in a central bank: models versus judgement (R) (S)	Lionel Price
4	Internal audit in a central bank (R) (S)	Christopher Scott
5	The management of government debt (R) (S)	Simon Gray
6	Primary dealers in government securities markets (R) (S)	Robin McConnachie
7	Basic principles of banking supervision (R) (S)	Derrick Ware
8	Payment systems (A) (S)	David Sheppard
9	Deposit insurance (R) (S)	Ronald MacDonald
10	Introduction to monetary operations – revised, 2nd edition (R) (S)	Simon Gray, Glenn Hoggarth and Joanna Place
11	Government securities: primary issuance (R) (S)	Simon Gray
12	Causes and management of banking crises (R) (S)	Tony Latter
13	The retail market for government debt (R) (S)	Robin McConnachie
14	Capital flows: causes, consequences and policy responses (R) (S)	Glenn Hoggarth and Gabriel Sterne
15	Consolidated supervision of banks (s)	Ronald MacDonald
16	Repo of government securities (s)	Simon Gray
17	Financial derivatives (s)	Simon Gray and Joanna Place
18	The issue of banknotes (1) (s)	Peter Chartres
19	Foreign exchange reserves management (s)	John Nugee
20	Basic bond analysis (A)	Joanna Place
21	Banking and monetary statistics (A) (s)	John Thorp and Philip Turnbull
22	Unit root testing to help model building	Lavan Mahadeva and Paul Robinson
23	Consumption theory	Emilio Fernandez-Corugedo
24	Monetary operations	Simon Gray and Nick Talbot

(1) Withdrawn from publication. An updated version will be released in due course
(A) Available in Arabic ; (R) Available in Russian; (S) Available in Spanish

Handbooks: Lecture Series

No	Title	Author
1	Inflation targeting: The British experience	William A Allen
2	Financial Data needs for macroprudential surveillance - What are the key indicators of risks to domestic financial stability?	E Philip Davis
3	Surplus liquidity: Implications for central banks	Joe Ganley
4	Implementing monetary policy	William A Allen

Handbooks: Research Series

No	Title	Author
1	Over the counter interest rate options	Richhild Moessner

BOOKS

The CCBS also aims to publish the output from its Research Workshop projects and other research. The following is a list of books published or commissioned by CCBS:-

Brealey, R, Clark, A, Goodhart, C, Healey, J, Hoggarth, G, Llewellyn, D, Shu, C, Sinclair, P and Farouk, S (2001), 'Financial Stability and Central Banks — A global perspective', Routledge.

Capie, F, Goodhart, C, Fischer, S and Schnadt, N (1994), 'The Future of Central Banking: The Tercentenary Symposium of the Bank of England', Cambridge University Press.

Davis, E P, Hamilton, R, Heath, R, Mackie, F and Narain, A (1999), 'Financial Market Data for International Financial Stability', Centre for Central Banking Studies, Bank of England.*

Driver, R, Sinclair, P and Thoenissen, C (2005), 'Exchange Rates, Capital Movements and Policy', Routledge.

Fry, M, (1997), 'Emancipating the Banking System and Developing Markets for Government Debt', Routledge.

Fry, M, Goodhart, C and Almeida, A (1996), 'Central Banking in Developing Countries: Objectives, Activities and Independence', Routledge.

Fry, M, Kilato, I, Roger, S, Senderowicz, K, Sheppard, D, Solis, F and Trundle, J (1999), 'Payment Systems in Global Perspective', Routledge.

Goodhart, C, Hartmann, P, Llewellyn, D, Rojas-Suárez, L and Weisbrod, S (1998), 'Financial Regulation: Why, how and where now?', Routledge.

Gray, S, Nell , J, (2005): ***A New Currency for Iraq,*** Central Banking Publications.

Halme, L, Hawkesby, C, Healey, J, Saapar, I and Soussa, F (2000), 'Financial Stability and Central Banks: Selected Issues for Financial Safety Nets and Market Discipline', Centre for Central Banking Studies, Bank of England.*

Mahadeva, L and Sinclair, P (2002), 'The Theory and Practice of Monetary Transmission in Diverse Economies', Cambridge University Press.

Mahadeva, L and Sinclair, P (2004), 'How Monetary Policy Works', Routledge.

Mahadeva, L and Sterne, G (2000), 'Monetary Frameworks in a Global Context', Routledge. (This book includes the report of the 1999 Central Bank Governors Symposium and a collection of papers on monetary frameworks issues presented at a CCBS Research Workshop.)

*These are free publications which are posted on our web site at

www.bankofengland.co.uk/education/ccbs/publications/index.htm

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