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Open market operations: beyond the new consensus

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Abstract

The emergence of the New Consensus in monetary policy has been followed by a renewal of interest in central banks' operating procedures, and specifically in the role of open market operations. There is a general view that overnight interest rates are most effectively controlled by standing or discount window facilities, rather than open market operations, and this view will probably now extend also to lender-of-last-resort intervention. The paper argues that this reduced role for open market operations is only in the context of controlling overnight rates of interest. In spite of the emphasis on control of overnight interest rates, medium and long-term interest rates remain the crucial instruments in the monetary transmission mechanism. Longer-term interest rates are susceptible to influence by open market operations, and their importance grows with financial development.

Key words: central banks, monetary policy, open market operations

JEL classification numbers: E52, E58

Avomarkkinaoperaatiot – mainettaan ehkä sittenkin parempi rahapolitiikan väline

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Tiivistelmä

Uuden konsensuksen esiinmarssi rahapolitiikassa on herättänyt uudelleen kiinnostuksen keskuspankin operatiivisia käytäntöjä, erityisesti avomarkkinaoperaatioita, kohtaan. Yleisesti ajatellaan, että keskuspankki pystyy kontrolloimaan yön yli -korkoja avomarkkinaoperaatioita tehokkaammin maksuvalmiusjärjestelmän tai diskonttoikkunan kautta ja että tämä pitäisi paikkansa myös hätärahoitusinterventioiden tapauksessa. Tässä työssä esitetään, että avomarkkinaoperaatioilla on vähäisempi merkitys ainoastaan yön yli -koron kontrolloinnissa. Vaikka rahapolitiikan painopiste on yön yli -koron konttrolloinnissa, on keskipitkän ja pitkän aikavälin koroilla keskeinen asema rahapolitiikan välittymismekanismissa. Pitkän aikavälin korot reagoivat herkästi avomarkkinaoperaatioihin, ja niiden merkitys kasvaa rahoitusmarkkinoiden kehityksen myötä.

Avainsanat: keskuspankit, rahapolitiikka, avomarkkinaoperaatiot

JEL-luokittelu: E52, E58

Contents

1   Introduction

The arrival of the 'New Consensus' as the guiding doctrine for monetary policy has coincided with a renewal of interest in the ways in which that monetary policy is implemented. Such a coincidence is not really surprising. It is obvious that the replacement of one guiding doctrine, laying out the effects of monetary policy on an economy, by another doctrine is not just decided by policy considerations, but also usually involves some re-examination of the way in which monetary policy is implemented. The practical operation of a guiding doctrine of the past is usually re-examined to show that not just administrative failures are responsible for the flaws in previous monetary policy. At the same time central bankers need clear procedures for the implementation of the new policy. The last change of monetary regime, the switch to controls of monetary aggregates during the 1970s, was also anticipated by the critique of monetary operations from Milton Friedman and guidelines for the operation of new policy from William Poole (Friedman 1959, Poole 1970). The monetary procedures for the previous regime of active, Keynesian monetary policies after the collapse of the gold standard, and procedural errors in gold standard operations, had been clearly laid out by Hawtrey and Keynes himself (Hawtrey 1938, Keynes 1930, Keynes 1945).

Similarly, the embrace by policy-makers of a 'New Consensus in Monetary Policy', the view that a central bank should set the short-term (overnight) rate of interest by regard to some target for future inflation, has also been associated with critiques of monetary policy procedures under the previous regime targeting monetary aggregates (eg Bindseil 2004). Indeed, such discussion of their operating procedures has been invited by central bankers as a way of clarifying their obligations. For example, in a recent speech to Lombard Street Research, the Bank of England's Executive Director for Markets, and member of the Bank's Monetary Policy Committee, Paul Tucker urged further research in this direction: 'The overall historical picture is not especially coherent. I suggest that the question of whether desirably or even optimally, there might be some mapping from monetary regimes to operating frameworks warrants research by the academic community.' (Tucker 2004, p. 372. Tucker refers to the Bank's procedures as its 'operating system', an intriguing example of the influence of technology on language.)

This paper looks at the role of open market operations in the 'New Consensus' system of monetary policy, both in central bank procedures and in the putative influence of monetary policy on the economy at large. The first section examines the place of open market operations in the central bank balance sheet. The second section summarises the New Consensus Monetary Policy and the reduced role offered to open market operations by prominent proponents of such policy. The third and fourth sections of the paper look at the implementation of

monetary policy, and how the optimum open market operations change the rate of interest is the operational target of monetary policy. The fifth and sixth sections of the paper consider the effect of financial development on the liquidity of financial markets, and the demand for central bank reserves. A seventh section discusses lender of last resort facilities. The eight section considers the impact of open market operations on the yield curve. The paper concludes by arguing that the operating procedures implied by the New Consensus on monetary policy, giving a reduced role to open market operations, may not be entirely appropriate for developing and newly-industrialised countries, and may give a somewhat too narrow view of open market operations in reserve currencies.

2 Open market operations in the central bank balance sheet

A useful starting point for a systematic examination of the role of open market operations is the balance sheet of a central bank. This offers, as will become apparent further in the paper, a framework in which to place current theory on monetary policy and operations. Following Bindseil (2004) the balance sheet may be divided up into two sections. First of all, there is an *autonomous balance sheet* whose elements are items over which the central bank has little day-to-day influence, although it may affect the *composition* of some of these items, for example, through the bank's choice of foreign currencies to hold in its reserves. (These are further discussed in section 4).

It should be pointed out that, although these autonomous elements have been separated out from 'monetary policy operations', this does not mean that those elements do not have monetary significance. Banknotes in circulation clearly have monetary significance. But it is now widely accepted that the amount of banknotes in circulation is determined by nominal incomes and how much of those incomes is required in cash. For countries operating a currency board, or just seeking to stabilise their exchange rate, foreign currency reserves have clear domestic monetary impact. But such countries are largely marginal to the existing largest monetary areas of the United States, the Euro-zone and possibly also the U.K., whose respective monetary policies have the largest impact on the international financial system. Furthermore, the movement in government deposits may have a significant monetary impact: tax and other revenues involve transfers from commercial bank reserves to the account of the government Treasury at the central bank; government expenditures transferring sums from the Treasury to the accounts in commercial banks of recipients of government payments; and sterilisation operations, in which government deposits are moved

from (or to) commercial banks in order to reduce (or increase) bank reserves. (These are further discussed in section 4).

Thus the section of the balance sheet headed *monetary policy operations* is really that part which summarises those monetary operations that are currently thought to be of significance among the major central banks whose practices inform contemporary monetary theory. In particular they may give a misleading impression of the main monetary policy operations of smaller central banks, and central banks in developing and newly-industrialised countries.

Until recently the most important section of the central banks' *monetary policy operations* balance sheet was that of the reserves of banks and monetary institutions. These are the deposits of commercial banks, which they use to clear payments with each other, and to withdraw banknotes from the central bank. (There is thus a significant connection between these reserves and the 'banknotes in circulation' liabilities item in the autonomous balance sheet. When banknotes in circulation increase, for example when people withdraw extra cash in advance of major holidays, commercial banks obtain additional banknotes from the central bank, and payment for them is debited to the commercial banks' reserve accounts at the bank). However important and visible may be the circulation of banknotes and payments in the economy, in practice the reserves needed for such circulation are insignificant: The total reserves of the commercial banks in the U.K. in 2004 amounted to £45 million, against which daily payments totalling over £150 billion were made through the CHAPS payment system (Tucker 2004, p. 361). The central bank reserves of the commercial banks, together with the item banknotes in circulation, have had a disproportionate importance for monetary policy, because these two items constituted the 'monetary base', 'high-powered money', or 'outside money' whose control was the central tenet of the monetarist view that is more precisely described as the 'reserve position doctrine' (Meigs 1962, Patinkin 1965, pp. 295–300).

Central bank balance sheet

OMO = Open Market Operations

Assets	Liabilities
1. Autonomous balance sheet	
Gold & Foreign currency	Banknotes in circulation
Investment assets	Government deposits
Other assets	Other liabilities
Capital and reserves	
2. Monetary policy operations	
OMO I (liguidity-injecting reserve operations – purchases)	OMO I (liquidity-absorbing reverse operations – sales)
OMO II (outright holding of securities from past liquidity injections)	OMO II (liquidity-absorbing central bank paper issued)
Liquidity-injecting standing facilities (borrowing facilities)	Liquidity-absorbing standing facilities (deposit facilities)
Operational reserves	Reserves of banks & monetary institutions

Source: Bindseil (2004), p. 48, rearranged.

The second, and increasingly important section of the *monetary policy operations* balance sheet are the standing facilities. These facilities allow commercial banks to borrow reserves from the central bank, or to place excess reserves on deposit at the central banks. Standing facilities are a way in which commercial banks can influence *at their discretion* the balance sheet of the central bank, since decisions to use standing facilities are made by commercial banks, rather than a central bank.

The main part of the *monetary policy operations* balance sheet shows open market operations divided into two sections. The first, OMO I, consists of reverse purchase (repurchase) or sale agreements with participants in the money market. A purchase agreement, for example, involves the purchase of risk-free longer-term securities, for example government bonds, for which payment is added to the reserves held at the central bank of the counterparty bank. The agreement then specifies the sale of those securities back to the central bank after a certain period. In the European Central Bank's practice this was initially two weeks, but is now one week. The difference between the purchase and sale price is in effect the rate of interest on the temporary addition to its reserves that the counterparty bank now obtains. This rate of interest on repurchase agreements ('repos') is now the official rate of the European Central Bank and the Bank of England. These open market operations may be repurchase agreements, providing reserves to counterparty banks, or they may be reverse sale agreements, reducing the reserves of banks.

For central banks, repurchase agreements have the attraction that reserves supplied are not supplied as loans to counterparty banks but are exchanged for top quality assets from banks' portfolios. Their other attraction is that they allow central banks to inject (or withdrawal) reserves over a fixed time horizon. This temporary accommodation offers central banks a way of acceding to any current requirement for reserves from commercial banks, without commitment to provide such reserves in the future. Such a commitment to provide all necessary reserves in the future is considered to remove the incentive to sound bank management that a reserve system is supposed to provide. ('… an efficient, safe and flexible framework for banking system liquidity management … should retain incentives for banks to manage their own liquidity actively and prudently.' Bank of England, 2004, p. 218).

Once repurchase agreements are in operation, then obviously their effect on the money markets is the net outstanding amount at any one time. So if there are weekly repurchase agreements, the central bank's manager responsible for money market operations decides, when the agreements expire, whether to renew them, or increase or decrease their amount. An increase in the amount of purchase agreements (or decrease in sales agreements) would supply additional reserves. A decrease in purchase agreements outstanding (or increase in sales agreements) would reduce bank reserves.

The other kind of open market operations are the outright purchases and sales of securities without commitment to sell or buy back the securities bought or sold. These are longer-term portfolio operations of central banks, and may include central bank issues of their own paper, for example, the short-term Euro notes that are issued by the Bank of England.

Whereas standing facilities are a way in which commercial banks can influence *at their discretion* the balance sheet of the central bank, open market operations are attempts by central banks to manipulate the balance sheets of counter-party banks. Since the make-up of their balance sheets is a commercial decision for those banks, central bank attempts to manipulate them require the consent of counter-parties. Hence, auctions are used for open market operations, with commercial banks being invited to tender for the securities that the central bank wishes to buy or sell. This has given rise to a modest, but significant, academic literature on the conditions under which commercial banks will 'over-bid' or 'under-bid' for the securities offered up for sale or purchase by the central bank (eg Ayuso and Repullo (2001). (Themes in recent research are brought together in Välimäki 2003, and Bindseil 2004, chapter 5). Needless to say, significant factors in over-bidding or under-bidding are the interest rates payable for standing facilities, or available in the money market (the alternative source of, or repository for, reserves).

(In personal correspondence, Charles Goodhart has pointed out that the effect of open market operations is the same irrespective of whether counter-parties are

settlement banks or other, non-bank, financial institutions. In fact, once a distinction between settlement and non-bank financial institutions is introduced, then open market operations may be used to force changes in their balance sheet upon settlement banks, regardless of their preferences. For example, the sale of bonds to a non-bank financial institution would be settled by a transfer from the reserves at the central bank of that institution's bank. Thus bank balance sheets may be changed even without their active participation in the open market operations of central banks).

The central bank balance sheet may be summarised as the following identity:

$$R_t \equiv M_t + B_t + A_t \tag{2.1}$$

where
R_t stands for Reserve holdings of banks,
M_t stands for Net Open Market Operations Position,
B_t stands for Net Standing Facilities,
A_t stands for Net Autonomous Factors.

Without further information, no causal inference may be made from this identity. However, it is used below as a convenient summary of the respective positions of different central banks on the role of open market operations in today's markets.

3   New consensus model of monetary policy

The new consensus on monetary policy may be briefly summarised as setting interest rates to secure target rates of inflation. This consensus emerged during the 1990s following the abandonment of the previous guiding doctrine of monetary policy, the view that the purpose of monetary policy is to manage the inflation through control of the money supply (however defined, given the range of money aggregates). (In fact the statement in a key text of that period, 'virtually all economists agree that there is an important role for public authority in managing the nation's high-powered money' (Goodfriend and King 1988, p. 244) was never true of all economists and central bankers and suggests caution in the use of the word 'consensus'.) In that doctrine, changes in that money supply were then supposed to affect inflation and the output gap.

The current view, termed the 'new consensus', may be derived from a simple macroeconomic model in which current inflation, π_t, is some function of the previous period's inflation and 'output gap'; x_{t-1}; a vector of exogenous variables, z_t; and some random variable, ε_t

$$\pi_t = \pi_{t-1} + \alpha_x x_{t-1} + \alpha_z z_t + \varepsilon_t$$

where α_x is some positive parameter; and α_z is a row vector of parameters; and ε_t is an identically independently distributed random variable with mean 0, and a given variance.

In turn, the output gap is measured as a function of the previous period's output gap; the vector of exogenous variables; the difference between the current real rate of interest, j_t; the natural or equilibrium rate of interest that keeps the price level stable; and some random variable η_t.

$$x_t = \beta_x x_{t-1} + \beta_z z_t - \beta_r (j_t - r) + \eta_t$$

where η_t is an identically independently distributed random variable, with mean 0, and a given variance and $\beta_x > 0$; $\beta_r > 0$.

The inflation function and the output gap equation can be combined and re-arranged to give an equation showing the impact of monetary policy operations on future inflation $(\pi_t - \pi_t + 1)$

$$j_t - r = \frac{(\pi_t - \pi_{t+1})}{\alpha_x \beta_r} + \frac{\beta_x x_{t-1}}{\beta_r} + \frac{\beta_z z_t}{\beta_r} + \frac{\alpha_z z_{t+1}}{\alpha_x \beta_r} + \frac{\eta_t}{\beta_r} + \frac{\varepsilon_t}{\alpha_x \beta_r} \qquad (3.1)$$

If expected values are put in for the future inflation, π_{t+1}, and future exogenous variables, z_{t+1}, then this can transformed into a dynamic equation showing forward-looking monetary policy operations. New Classical economists tend to be rather sanguine about the foresight of 'agents', whereas central bankers largely accept that such foresight is largely based on past experience. If the lag structure is changed and future exogenous factors are reduced to zero, then a Taylor Rule for monetary policy may be obtained. If the lags and equation are re-arranged to put future inflation or the output gap as the dependent variables, then an equation for the monetary transmission mechanism may be obtained. Given the autocorrelation and collinearities in business cycle data, different versions of this equation find support in econometric studies.

It is also worth pointing out that the time subscript in equation (3.1) is a period average, rather than the *point* time subscript in identity (2.1). This does not mean that the two equations cannot be combined by, for example, averaging the central bank balance sheet over an extended period. However, such a combination may not be very illuminating where the clear focus of monetary policy is the over-night rate of interest, that is supposed to be managed by relatively frequent balance sheet operations. It is unlikely that meaningful series for inflation, and the output gap, not to mention unspecified exogenous variables, could be obtained for such short periods.

The operating target of New Consensus policy-making is the over-night rate of interest, as opposed to the money supply in the previous doctrine. The new system is a major and welcome simplification in economic modelling, since the relationship between the interest rates that are the independent variables in models of the monetary transmission mechanism and the money supply, while elegant in theory, always proved troublesome in practice. Charles Goodhart has remarked in the past on the tendency of the money supply to elude control, and the Volcker experiment from 1979 to 1982 in stabilising the monetary base also succeeded in destabilising the interest rates through which monetary policy was supposed to be transmitted to the rest of the economy. Since changes in the money supply were supposed, in any case, to operate through the rate of interest (the IS component of macroeconomic models, from which the Phillips Curve was derived), it makes sense where possible to control that rate of interest directly. This then leads onto an examination of how interest rates can be controlled, and the role of open market operations in that system of control.

4   The optimum level of open market operations

Central banks have relatively little direct control of interest rates. As was indicated in section 1 of this paper, operations in the money market, where over-night interest rates are set, require the co-operation of counter-party banks. In the case of the longer-term rates that are crucial for the monetary policy transmission mechanism, the influence of central banks is even more tenuous. Even the Bank of England's Bank Rate under the gold standard, which is sometime referred to by partisans of the 'New Consensus' as the golden age of interest rate targeting (eg Bindseil, 2004, pp. 10–16; Tucker 2004, Appendix 3; Woodford 2003, 93–94), regularly lagged behind money market rates. Indeed, once it became clear that money market interest rates, rather than the amount of base money, were the targets of central bank monetary operations, the practical need to concentrate money market rates around the central bank's preferred rate became a key factor in changing central bank operating procedures, both in the Euro-zone, and in the U.K. The setting of an official discount or lending rate may of course have a significant 'signalling' effect in the money markets. But, without operations in the money markets, such signalling may have only a marginal impact on interest rates in those markets (Friedman 1999).

As section 1 of the paper indicates, operations in the money markets may be conducted through open market operations, or through the use of standing facilities, sometime also called the discount window. The previous, monetarist, monetary policy regime, undoubtedly favoured the use of open market operations. In part this was a legacy of the 1930s, when open market operations seemed to

offer a direct way of counteracting a catastrophic credit contraction (Hawtrey 1938, Simons 1946). This preference for conducting monetary policy through open market operations was encouraged in recent central bank practice through the influence of Simons' most prominent student, Milton Friedman. Even prior to the monetarist regime, open market operations were a favoured way of implementing policy. For example, in the early 1980s the Bank of England described its monetary operations as:

'…setting, and periodic variation, of an official discount or lending rate, which, when necessary, is "made effective" by open market operations in the money market. "Making Bank rate effective" means restraining a decline in market rates from an unchanged Bank rate, or bringing them up to a newly established and higher Bank rate; it is accomplished by limiting the availability of cash to the banking system so as to "force the market into the Bank" to borrow at the somewhat penal rate of Bank rate.' (Bank of England, 1983 p. 213)

Under the monetarist regime, the conduct of monetary policy operations was supposed even to exclude standing facilities, or discount window operations. As an authoritative paper by Goodfriend and King on U.S. Federal Reserve policy argued 'the discount window is unnecessary for monetary policy… …Open market operations are sufficient for the execution of monetary policy. It follows that unsterilized discount window lending is redundant as a monetary policy tool.' This was followed by a cautionary note: 'Nevertheless, over the years the Federal Reserve has employed unsterilized discount window lending extensively, together with discount rate adjustments, in the execution of monetary policy. Though it remains puzzling, use of the discount window this way seems to be connected with the use of secrecy or ambiguity in monetary policy.' (Goodfriend and King 1988; see also Schwartz 1992). In fact, the diversity of banks in the different regions of the Federal Reserve system has traditionally been a factor in the use of the discount window in the U.S.

This approach can be summarised by re-arranging the central bank balance sheet identity (2.1) to yield

$$M_t \equiv -A_t + (R_t - B_t) \tag{4.1}$$

An implication of this approach was that the term in brackets, the balance between changes in the reserves position of commercial banks (member banks in the case of the Federal Reserve), R_t, and discount window operations, B_t is negligible. Thus the autonomous shifts in liquidity of the banking system, A_t, were supposed to evoke the targeted amount of reserves from the central bank or, in the case of the Bank of England's policy, were supposed to force the money market banks to borrow from the Bank at its preferred rate.

In a somewhat confessional (for a central banker) aside the Bank of England's Executive Director for Markets admitted: 'With no deposit facility... the OMO rate was a natural way to express policy and we slipped into thinking of it as how we actually implemented policy too. That was a fallacy.' (Tucker 2004).

The 'New Consensus' view of monetary policy has reversed the accepted view on the relative importance of open market operations and standing facilities. If standing facilities are available to participants in the money market, then the standing deposit and borrowing rates form a 'corridor' between which the market rate will fluctuate. *How* it will fluctuate depends on the other elements in the balance sheet identity (2.1), namely the amount of reserves that banks need on any one day; the amount and frequency of open market operations; and the credit activities of banks. For convenience this last is sometimes modelled as a stochastic variable (eg in Davies 1998). If minimum reserves are required to be held at the end of every day, and that minimum is sufficiently large in relation to the daily fluctuation in credit activities, then, without accommodating open market operations, the overnight rate in the money market will tend to the upper and lower bounds of the corridor. One way of moderating this drift to the margins is allow banks to average their reserve requirements over a maintenance period. In that case, the overnight rate will fluctuate between the deposit and lending rate, but will tend to end up on one of the corridor margins at the end of the maintenance period. The new arrangements for implementing monetary policy by the Bank of England envisage averaging with a wide corridor (100 basis points on either side of the official rate), to discourage use of standing facilities on a daily basis, but a narrower corridor (25 basis points on either side of the official rate) on the final day of the reserve maintenance period (Clews 2005, p. 211).

Thus, in the operational framework for the 'New Consensus' monetary policy, open market operations become redundant for the purpose of keeping the overnight interest rate close to the official interest rate. For example, the leading theoretician of the 'new consensus' Michael Woodford has argued that, even with the zero reserve requirement that is implied by his assumption of a 'pure credit' economy, all that is required to keep the overnight money market rate at the official rate is for the central bank to offer a deposit facility at the official rate (Woodford 2003, pp. 32, 33). However, this is because the deposit facility he envisages would only provide a risk-free asset to the banking system, giving the money market a benchmark rate of interest on such assets. In the 'pure credit' economy that he envisages, all autonomous movements in banks' currency would be accommodated in 'complete markets'. Hence not only the absence of reserve requirements, but also the reduction of the banking system's autonomous reserve requirements for payments purposes to zero, would eliminate the need for open market operations.

However, Ulrich Bindseil has recently raised another issue that has not been discussed in the academic literature, although it appears among the practical

considerations that have been advanced in the establishment or reform of central bank operating procedures (eg Bank of England 2004). This is the degree to which open market operations that deprive the banking system of reserves in order to induce the borrowing of reserves from the central bank, thereby cause the central bank effectively to replace the activities of the money market ('bringing the market into the bank'). His argument is that 'open market operations should ensure that the recourse to standing facilities is not structural, but covers only non-anticipated probabilistic needs… …Today, the essential argument advanced for open market operations is that they do not, in contrast to standing facilities offered at market rates, dry up the short-term inter-bank money market.' (Bindseil 2004, pp. 144 and 177). His concern is to minimise the tendency of commercial banks to draw routinely on standing facilities. Unchecked, this may turn the central bank into a giro-clearing system for the banks, as the German Reichsbank was before the First World War. In such giro-clearing all autonomous movements in currency and reserves end up as book-keeping transfers in the central bank's balance sheet. It would require central banks to price the riskiness of lending to individual banks on a routine day-to-day basis, something that they would prefer the money market to do (Clews 2005). This is an aspect of central banks' operations in money markets that has not been adequately discussed in the academic literature.

The reduced scope of open market operations is reflected in the reduction of the Bank of England's operations from two or three each day, to one each week, plus another operation on the last day of each maintenance period, although additional open market operations will be undertaken to prevent a build-up of reserves that would render the banking system independent of the central bank's official rate (Clews 2005). In the 'New Consensus', in which monetary aggregates are no longer supposed to matter, but monetary policy is conducted by movements in the official rate of interest, the new function of open market operations is not a monetary, one in the sense that the scale of these operations is unrelated to the rate of interest that the central bank seeks to enforce in the money markets, or to the monetary policy stance that the central bank is adopting, ie, the trend in interest rates that the central bank seeks to indicate to the financial markets. The function of open market operations in the new consensus is to prevent settlement banks from 'forcing the money markets into the bank' by using remunerated standing facilities as a form of cash management service.

The present operating procedures of the European Central Bank (detailed in European Central Bank 2005) may be summarised as conducting open market operations in such a way as to accommodate changes in the predicted autonomous movements in reserves of settlement banks as a whole, while leaving the money market to distribute the required reserves among banks. In this way, only marginal differences between reserve requirements and autonomous reserve movements out of the banking system have to be accommodated by standing facilities

$$M_t - A_t \equiv (B_t - R_t) \tag{4.2}$$

Above those marginal differences, open market operations are merely matched by off-setting standing facilities. The scale of open market operations is therefore maintained at the lowest level consistent with enforcement of the official interest rate in the money market. This is the system which the Bank of England is now adopting, although using voluntary reserve requirements, rather than the compulsory ones in effect in the Euro-zone area (Clews 2005).

Two points may be made in conclusion to this section. First of all, despite the rhetorical denunciation of day-to-day bank reserve management in the 'new consensus', reserve requirements continue to have their rationale in the day-to-day implementation of monetary policy in supplementing the effectiveness of open market operations, rather than in the prudent conduct of banking business. Secondly, the current reform of money market operations by the Bank of England is not only a reaffirmation of the targeting of overnight interest rates through procedures common now in Europe, Canada and New Zealand. It is also a recognition that the scale of open market operations that were required by the previous management of bank reserves and liquidity was 'bringing the money market into the Bank'. As recently as the Bank of England's discussion around its last reform of procedures in 1997, open market operations were treated as more or less perfect substitutes for standing facilities (Bank of England 1997).

5   Autonomous movements in bank reserves

So far this paper has not gone into the question of what constitutes the 'movements in autonomous factors' that are the basis of central banks' accommodation of the reserve requirements of the banking system as a whole. These movements can formally be divided up into:

–   The change in the amount of banknotes in circulation; plus
–   The change in government deposits; plus
–   Net purchases by the central bank of foreign currencies.

(There is also a small item referred to somewhat broadly as 'other factors (net)'. However, this is a balancing item that includes all the remaining balance sheet items affecting money market liquidity. See European Central Bank 2001, pp. 74–75.)

The change in the amount of banknotes in circulation is affected by largely predictable seasonal factors (eg cash withdrawals by the public before shopping festivals such as Christmas), as well as long-term trends towards cash-less

payment. Changes in banknote circulation affect the level of reserves of the banking system because their holding of central bank notes is included in bank reserves, and because banks obtain additional banknotes by drawing down on their reserve accounts at the central bank.

The change in government deposits is a key, and controversial element in autonomous factors. Payments to the government reduce the outstanding deposits of the banking system. A part of the monetarist monetary control doctrine was the view that the net fiscal deficit was an addition to the deposits of the banking system. Moreover, in many developing countries government paper is a major part of the assets of central and commercial banks. Trading in government paper is an important part of the liquidity management of banks, that was recognised notably in the Radcliffe Report (Kahn 1972). There is a tendency to overlook the importance for monetary policy of such trading. For example, the recent literature around the operating procedures of monetary policy naturally emphasises the effect on overnight interest rates of central bank management of the reserve base of the banking system. In a situation in which banks can only obtain reserves from each other or by accommodation from the central bank, failure to accommodate a shortage of reserves in the banking system, or to remove excess reserves from the system, would give rise to extreme fluctuations in overnight interest rates (eg Davies 1998).

In fact banks can 'force' the provision of reserves, or decline to surrender excess reserves, by reducing their purchases of short-term Government paper. By allowing their existing holdings of Treasury bills to mature without replacement with other paper, the banking system as a whole can obtain reserves transferred from the Government account at the central bank. To avoid this, the Government debt managers would have to offer a higher yield on Treasury bills. In this way the stability of the overnight rate of interest may be obtained at the cost destabilising other rates of interest. (If the Government holds its account with a commercial, settlement bank, rather than the central bank, then the Government's commercial bank becomes the supplier of reserves 'forced' in this way by the rest of the banking system.) If the Treasury bills market dries up, banks can 'force' reserves (means of inter-bank settlement) from each other by allowing company paper to expire without buying replacement paper. If the company paper market dries up as well, banks can sell foreign exchange, forcing reserves from banks that buy it, or from the central bank if it intervenes to avoid the appreciation of the domestic monetary unit. In all these cases, the re-distribution of reserves among commercial banks may occur not at an equilibrium rate of interest established in the overnight market for reserves, but at the cost of potentially destabilising movements in other prices for short-term financial assets. In theory such movements should not exceed the 'corridor' of interest rates available on standing facilities. In practice, such movements need only be sufficient to arouse

expectations of further movements in the future, for those prices to succumb to speculative instability.

In effect, Government paper is in varying degrees a substitute for central bank reserves. The relatively recent (more or less since the establishment of modern reserve banking just prior to the First World War) emphasis on banks' reserve accounts at the central bank as final means of settlement of payment between banks, has tended to obscure the use for that function of Treasury bills before reserve banking was established, and along-side it afterwards. The decline of the Treasury bill market in the U.K. in recent years may also have contributed to promoting the notion that reserves at the central bank are the only possible means of settlement between banks.

Banks use of such substitutes may be expected to vary with the yields on maturing Treasury bills, relative to the rate of interest on standing facilities. If the rate on borrowed reserves is lower than that on maturing Treasury bills, it would pay to borrow reserves and invest in Treasury bills. If the rate of interest on reserve deposits is higher than on Treasury bills, then a profit may be obtained by allowing Treasury bills to mature, and investing the proceeds in reserve deposits. The overall effect would be to drive Treasury bill rates towards the extremes of the standing facilities 'corridor' of interest rates. In this situation, open market operations, to supply reserves in place of borrowed ones or to reduce reserve deposits, would tend to accelerate the movement of Treasury bill yields towards the extremes of the 'corridor'. Hence, the narrower the corridor, the more stable is likely to be the rate of interest on maturing Treasury bills.

The other autonomous factor, which may be mentioned here, is net purchases by the central bank of foreign currencies. Recent discussion of central bank operations (eg Bindseil 2004, Woodford 2003, Bank of England 2004, European Central Bank 2001) have tended to ignore this factor, in line with the monetary policy doctrine, prevalent in particular after the collapse of the Argentine currency board, that favours floating exchange rates. This may be an appropriate simplification in relatively closed economies, such as the United States or the Euro-zone; or even in countries whose structural trade surpluses, such as Japan, give them a sustainable trade position irrespective of the exchange rate. However, it is not appropriate in the case of many developing and newly-industrialised economies, whose small domestic market, relative to their foreign trade, means that import prices have a major influence on the domestic price level. In such relatively smaller economies, the domestic rate of interest cannot be set without consideration of the effect that the domestic rate might have on capital flows. With a liberalised capital account, the central bank is obliged to enter the foreign exchange market, to stabilise the effect on the exchange rate, and hence on the domestic price level, of foreign capital flows.

The considerable influence of the exchange rate on the domestic price level, is a distinctive feature of developing and smaller, more open, economies. At the

very least this influence qualifies the neo-Wicksellian view according to which the rate of inflation is determined solely by the difference between the (domestic) 'natural' rate of interest (the marginal productivity of capital), and the (domestic) money rate of interest set by the central bank. At the same time, a narrow orientation of open market operations towards stabilising the over-night rate of interest on bank reserves may cause the central bank to overlook developments in asset prices further out along the yield curve. In section seven below it is argued that the central bank cannot avoid influencing asset prices, in particular prices of financial assets, and experience suggests that a central bank can stabilise such prices (Goodhart and Dai 2003).

6   Open market operations and financial development

The commonly accepted definition of financial development is the creation of *more liquid* markets in longer-term securities. The classic statement of this was made forty-five years ago in Gurley and Shaw (1960). However, it nowadays includes an increasing range of short-term securities, such as futures and foreign exchange contracts. By increasing the scale of financial transactions financial development increases the autonomous movements in reserves. By making financial markets generally more liquid, financial development reduces the impact that given central bank open market operations have on interest rates in the money market whose instruments now find more ready substitutes among more liquid longer-term securities. Financial development also increases the amount of bank deposits in the system. If the money supply is divided up into 'outside' money that is the liability of the central bank, and 'inside' money, that is made up of liabilities of commercial banks, financial development may be viewed as the expansion of 'inside' money relative to 'outside' money. (This is the origin of the now standard use of the ratio of M3 to M0 as an indicator of financial development, eg King and Levine 1993.) In turn, the increase in 'inside' money relative to 'outside' money makes it more difficult to enforce the official rate of interest in the money market. At the same time, the increased reserves that would have to be held against such deposits would tend to 'bring the money market into the central bank'.

Financial development has two effects on the autonomous movement of reserves in the banking system that are relevant here. On the one hand there is, with a constant value of individual transactions, a Jevons-type 'Law of Large Numbers' effect, tending to stabilise the net outflow of reserves from the banking system, as more transactions increase the tendency of outflows and inflows to cancel each other out. This effect stabilises outflows most in the initial increase in

the numbers of transactions, so that with financial development it is of diminishing importance. The other effect is the tendency with financial development for transactions to get larger, with the growing importance of money-centre activities and large-scale securities trading. This combines with secular trends and medium-term cyclical movements in transactions that directly involve large movements in bank reserves (for example, international movements in bank deposits or changes in the fiscal position of the government). This effect would tend to increase the scale of autonomous movements in bank reserves. (The other factor in the scale of autonomous movements in bank reserves has historically been banks' transactions in international reserves, namely gold, during the period of the gold standard, and foreign currency, in the case of emerging markets today. Capital account liberalisation obviously increases the scale of open market operations necessary to keep monetary aggregates stable. As was mentioned in section 4, small open economies may still require large scale open market operations in foreign assets to keep the exchange rate stable.)

In Patinkin's neo-classical Keynesian interpretation, financial innovation means that, for a given level of nominal aggregate demand, less money is demanded, because securities are more liquid: '…the result of developing nonbanking financial intermediaries is to provide ultimate lenders with the possibility of purchasing a security which is more attractive (more "liquid") than the primary securities issued by the ultimate borrowers' (Patinkin 1972, p. 46; Gurley and Shaw 1960, pp. 123–126). In a later postscript, Patinkin argued that the effect of this is to increase the amount of open market operations required to obtain a given *change* in the real rate of interest:

'…the existence of [non-bank] financial intermediaries does not, in principle, impair the efficacy of open-market policy. Theoretically, it only affects the conditions under which the monetary authorities operate in the bond market: that is, it affects the volume of operations that the authorities must carry out in order to establish a given rate of interest.' (Patinkin 1972, p. 54.) In the non-stochastic, static, general equilibrium model that Patinkin was describing, open market operations were only necessary to *change* interest rates, after which a stable equilibrium would emerge. By contrast, the autonomous movements in the reserve position of the banking system as a whole, given in equation 2.1 and in this section, are usually modelled as being subject to stochastic shocks, even though in practice they are largely predictable (see previous section 5). Moreover, it should be pointed out that open market operations can only directly influence the *nominal* rate of interest. The eventual *real* rate of interest depends on the course of price inflation over the period *after* a security has been issued. The demand for money that Patinkin had in mind was the demand for real money balances, in relation to the real rate of interest. To put this in the context of the new consensus monetary policy, it is necessary to convert this demand, and supply through open market operations, as well as the real rate of interest, back into nominal values. This is

easily done by multiplying through by the price level that was originally used to obtain real variables. With a flatter, more interest-rate elastic demand curve for money, or for the reserves held against bank deposits, financial development requires a central bank to increase the amount of open market operations necessary to enforce a given change in the rate of interest. By contrast, in the 'New Consensus' the policy of the central bank is orientated towards stabilising the overnight rate of interest around its official rate, by off-setting (through open market operations or standing facilities) autonomous movements in the reserves of the banking system as a whole. If those autonomous movements increase in scale, as they would with capital account liberalisation in emerging markets, or with the expansion of money centre activities, then the amount of off-setting that has to be undertaken by the central bank is correspondingly increased.

As has already been noted, financial development involves the more rapid expansion of 'inside' money, that is a liability of the banking system, relative to the 'outside' money (bank reserves plus cash) that remains a liability of the government, or of the central bank. (Patinkin 1972). Financial development and the more rapid growth of 'inside' money obviously increases the range of credit activity that may be undertaken on the basis of a given quantity of bank reserves. At the same time, for any positive reserve requirements, actual reserves that have to be kept in the banking system rise with the *gross*, rather than the *net* liabilities of the system. *Any* loan that is granted, for example, against the collateral of long-term securities, becomes on its use as payment a deposit against which additional reserves have to be set aside in a liability-based reserve system. This is true *a fortiori* of asset-based reserves, such as the Basel Accord system. (In this respect, the composition of household sector financial assets may give a misleading impression of the changes taking place in the course of financial development. There is undoubtedly a reduction in the share of bank deposits in household sector financial assets, but bank balance sheets in fact have been mainly expanded by the growth of money centre banking activity. Cf. Palley 2004, and Toporowski 2006.)

Without a change in open market operations to accommodate the structural increase in reserves required by the banking system, there would be a rising demand for reserves from standing facilities. This would tend to 'bring the money market into the central bank', making the central bank the first supplier of reserves in case of need. The money market would then tend to 'dry up'. If standing facilities were capped, then interest rates in the money market would tend to rise. If the central bank supplies reserves through open market operations, then net sales will fall off and may even be transformed, at a given reserve requirement, into net purchases. Over an extended period, a structural requirement may emerge within the banking system for good quality, risk-free assets for the central bank to buy in exchange for reserves. Were this to become an effective constraint, a central bank would be under pressure to reduce reserve requirements making it even more dependent on open market operations to enforce the official

rate of interest in the money market. (Harri Hasko has pointed out to me that, in the case of the European Central Bank, the good collateral held by banks available for open market operations has amounted to some €7–10 trillions, compared to the amount traded in particular open market interventions of some €300m. In the initial period of fixed rate tenders, banks were tendering for up to €7 trillions, effectively seeking to exchange the whole of their portfolio of good assets for reserves!)

Thus the current success of the European Central Bank in controlling overnight interest rates with its current open market operations and the existing level of reserve requirements, may not be sufficient to secure such control in the future. The much planned and anticipated European financial integration project may well make the existing scale of operations and reserve requirements less efficient. Without changes in operating procedures: an increased scale of open market operations, with larger and possibly more frequent fine-tuning bond sales, and structural purchases of securities, together with adjustments in reserve requirements; the official rate may end up disconnected from money market rates, as it historically has been.

7   The lender of last resort

The issue of the central bank's operations as a lender of last resort is a relevant consideration in the theory of optimum open market operations because of central banks' preference, mentioned in the previous section, for the money markets themselves to assess the risks of banks. Excessive open market operations that 'bring the money market into the central bank balance sheet' obviously involve the central bank in the routine assessment of counter-party bank risks. But when the central bank acts as a lender of last resort, the bank in effect takes on the most extreme bank risks. This leaves the money market to assess all the less extreme risks. Without specifying those risks it is difficult to judge what additional administrative burden would be involved in estimating an appropriate lending margin against those risks. But it may be that, once the central bank takes responsibility for extreme risks, the argument for not absorbing the money market into the central bank's balance sheet is correspondingly weaker.

In the previous monetary regime, considerations of monetary control as well as market assessment of risks argued in favour of using open market operations to inject assistance into the money market. Milton Friedman had argued that bond purchases in the open market allowed distressed borrowers to obtain liquidity without going to the discount window or standing facilities when no-one else will lend (Friedman 1959). Indeed, following the large scale assistance given to Continental Illinois Bank through the discount window in May 1984, resort to the

discount window came to be associated with the 'shame' of inability to raise liquidity in the money markets. Humphrey & Keleher argued that open market operations have the advantage of speed as well as regulating the total amount of reserves, but not their allocation among particular users' (Humphrey & Keleher 1984). George Kaufman argued that:

'Reliance on open market operations to provide assistance reduces the political pressures on the LLR to assist all entities in financial distress – in particular, financially weak, but politically strong entities directly through the discount window… Only if the central bank had superior or more timely information about the nature of the crisis or the solvency of the participants involved than the market does, should providing assistance through the discount window dominate open market operations…Open market operations eliminate the need to price LLR assistance correctly…An administered penalty rate [per Bagehot] is by necessity an imprecise concept that is as likely to be mispriced as priced correctly.' (Kaufman 1991).

The classic statement of monetarist central bank practice, Goodfriend and King (1988) urged that open market operations be used to supply reserves to the banking system, which could then allocate those reserves through the money market. If discount window assistance is provided, it should be sterilised, that is the central bank should sell in the open market the assets that it had bought through the discount window. In this way the overall reserve position of the banking system is kept constant, and the central bank in effect sells assets on behalf of the distressed bank. However, this procedure is considered to be inferior because it requires the central bank to monitor and supervise the bank to which assistance is being provided. Goodfriend and King contrast this 'monetary policy' with 'banking' by which unsterilised assistance is provided.

The policy of 'banking' was espoused by Charles Goodhart, who argued that discount window, or standing facility lending is the most efficacious means of intervention in the event of bank failure. He has associated this with the view that, in times of financial crisis, information asymmetries become extreme. Under such circumstances, the information widely available in the money market is simply inadequate for the purpose of properly calculating risk margins (Goodhart 1999, Goodhart and Illing 2002, Goodhart and Huang 1999).

The operating procedures recommended for the New Consensus Monetary Policy involve a significant reduction in the frequency and scale of open market operations. For example, in the U.K., weekly open market operations, plus another intervention at the end of each maintenance period, will replace between two and four open market operations each banking day (Tucker 2004). In this situation, entering the market to buy securities, the preferred method of intervention under the previous regime, becomes a highly visible way of conducting lender of last resort operations. If the market was unaware of possible distress among banking institutions, the market could not remain unaware

following such an intervention. Among the consequences would be a hunt to discover the identity of the weak, or potentially weak, institutions, if only to make a 'market' assessment of the risk they pose. It is difficult to imagine a more effective way of sowing panic in the money markets and thereby undermining their smooth functioning and routine risk assessment.

The new operating procedures will therefore favour lender of last resort operations by 'banking' means, a vindication of the Goodhart view. The issue that they pose for central bankers is whether to let distressed banks draw all their liquidity needs from the discount window or standing facilities; or whether banks applying for such facilities should not in some way be screened. For example, an individual bank drawing on such borrowing to an extent that might indicate possible distress, may be subject to further examination and, if necessary, also to a penalty rate for borrowing as indicated by Bagehot. In any case, the issue is less likely to fall within the scope of open market operations, unless a general shortage of liquidity emerges.

8   Enforcing monetary policy

In the New Consensus, monetary policy is targeted at regulating the rate of inflation. This can be illustrated by rearranging equation (4.1) to give

$$\pi_{t+1} - \pi_t = \alpha_x \beta_r (r - j_t) + \alpha_x \beta_x x_{t-1} + \alpha_x \beta_z z_t + \alpha_z z_{t+1} + \alpha_x \eta_t + \varepsilon_t \qquad (8.1)$$

For a central bank, the previous period's output gap, x_{t-1}, and the other economic influences on inflation summarised in z_t and z_{t+1}, are all exogenous variables. The main instrument that the central bank has at its disposal is the rate of interest and, for operational purposes, the overnight rate of interest. However, it is widely known that the overnight rate of interest has a direct impact only on the participants in the money market. The effectiveness of the overnight rate of interest depends on the degree to which that rate influences longer-term rates, for example, monthly rates of interest which are supposed to determine the price of most household borrowing, and ten-to-twenty year rates, or even the indefinite rates on company stock, which are supposed to determine financing costs of business fixed investment (Bindseil, 2004, p. 249, Bank of England 1999). These are now commonly modelled as margins over overnight rates of interest. But these margins are by no means fixed and, with certain notable exceptions (eg Hawtrey 1938, Biefang-Frisancho Mariscal and Howells 2002), there is little research conducted on the mechanisms responsible for movements in those margins, and the absolute levels of those longer-term rates. It is generally presumed that these

longer rates move up and down with changes in overnight rates of interest, and expectations concerning those changes.

As mentioned earlier, the literature on open market operations has developed some useful models demonstrating the effects of over-bidding and under-bidding on the eventual yield on securities bought or sold by tender in the process of open market operations (eg Ayuso & Repullo 2001). An important distinction in such operations arises between outright purchases and sales of securities, and repurchase, or reverse purchase, agreements. In the case of the latter, the absolute yield at which the two transactions (purchase, followed by sale back; or sale followed by purchase back) are conducted is unimportant. What matters is the margin in between the two prices of the transactions, representing the rate of interest on the reserves sold or bought in the market. For example, if a central bank wishes to enforce an official rate of 2% over the term of a repurchase agreement, then it will be indifferent between selling a bond at €100, for repurchase at €98, and selling that bond at €50 for repurchase at €49. However, in the case of outright purchases and sales of securities whose term matches the period in between regular open market operations, the price of the transaction and hence its absolute yield represents the effective rate of interest.

This distinction has important implications for the yield curve. There is an obvious convenience for central banks in trading longer-term securities in its open market operations. But the central banks' indifference to the absolute yields on longer term securities does not mean that it is not influencing those yields by providing liquidity to the market for those securities, albeit through the balance sheets of participants in the money market (Keynes 1930, p. 371). As Patinkin pointed out, to persuade banks to purchase or sell a security, the central bank has to make its offer or bid price attractive *relative to the price in the market for that security* (Patinkin 1972). In this way, open market operations make the longer-term rates of interest endogenous to the conduct of monetary policy.

This endogeneity of longer term rates of interest may be less apparent because the central bank can choose the instruments that it chooses to buy or sell in open market operations, ie where along the yield curve it intervenes. However, its provision of reserves against the collateral that it may choose does not mean that the central bank is not providing liquidity to other financial markets as well. In the final analysis, the liquidity of a market for a particular may be indicated by turnover in that market. But its main determinant is the liquidity of the portfolios held by participants in that market. It is, after all, the liquidity of their portfolios that determines their responsiveness to changes in relative yields along the yield curve. The provision of liquidity against particular, widely held, assets indirectly provides liquidity against other assets as well and, through their liquidity premium, influences their nominal yield.

9   Conclusion

As was noted in section 6, financial development creates a growing structural need for reserves and possibly larger autonomous movements in bank reserves that would need to be off-set by larger open market operations to keep the targeted rate of interest stable. At the same time an increasing involvement of the central bank in managing the liquidity of the banking system would tend to be undermined by the increasing liquidity of short-term securities that can thus more effectively substitute for central bank reserves as means of payment. In this situation, the central bank faces a choice between increasing the scale of its open market operations, in order to make its preferred rate of interest hold in the market, or increasingly relying on the 'signalling' effect of its official rates of interest. Open market operations have the additional property of influencing directly or indirectly liquidity and yields in other markets. This is obviously desirable given the much greater importance of medium and longer-term rates of interest in the monetary transmission mechanism. However, if they do have that greater importance, then it is those rates of interest that should be targeted, rather than overnight rates of interest.

Secondly, the theoretical literature on the New Consensus is neo-Wicksellian in explicitly identifying the difference between a 'natural' rate of interest (the marginal product of capital) and the money rate of interest as the cause of changes in the value of money. This may be plausible in large, relatively closed, economies, and is reflected in the exclusion of foreign exchange transactions from the monetary policy operations in the central bank balance sheet used by authors such as Bindseil (2004). But for the majority of smaller, open, economies, and in particular in developing and the newly-industrialised countries, the exchange rate is a major influence on the domestic price level. In such economies, the open market operations of the central bank can only exclude operations in the foreign exchange markets at the cost of making those economies subject to inflationary and deflationary international capital flows. The sterilisation of such flows (by the sale of domestic bonds and the purchase of foreign bonds, in the case of an inflow, reversing into the purchase of domestic bonds and the sale of foreign bonds) may help to stabilise bond markets. But they would need to be linked to foreign currency interventions if they are to be made effective in exchange-rate sensitive economies. Moreover, an implication of this is that, in the financial markets of a country whose currency has reserve currency status, it is not just the central bank of that country that is conducting open market operations. Other central banks are also operating in that currency and using deposits in that currency as means of settlement in foreign exchange transactions. In this way, in globally integrated banking markets, no central bank can isolate its open market operations from the foreign exchange market. Nor can targeting of the overnight

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rate of interest assure monetary stability as financial development increases the availability and liquidity of substitute reserves.

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