



Surplus Liquidity: Implications for Central Banks

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Abstract

Surplus liquidity occurs where cashflows into the banking system *persistently* exceed withdrawals of liquidity from the market by the central bank. This is reflected in holdings of reserves in excess of the central bank's required reserves. The occurrence of surplus liquidity is widespread, covering many countries around the world. Historically, it has been observed most often in Soviet, wartime and transitional countries. Transitional economies, for example, often attract large capital inflows as the economy opens and undergoes privatisation. The effect of these inflows on liquidity is often magnified by central bank intervention in the foreign exchange market when there is upward pressure on the domestic currency. In the wartime economy, consumption is restricted and large amounts of involuntary savings accumulate until goods and services eventually become more widely available. Soviet-style economies have displayed widespread shortages and administered prices. This creates a situation of repressed inflation, whereby prices are too low relative to the money stock, leaving individuals with excess real balances. The importance of surplus liquidity for central banks is threefold and lies in its potential to influence: (1) the transmission mechanism of monetary policy; (2) the conduct of central bank intervention in the money market, and (3) the central bank's balance sheet and income.

1. Introduction¹

Surplus reserves in the banking system are common in countries across the world. They arise where the banks' working balances on accounts at the central bank persistently exceed the required level of reserves. In other words, surplus liquidity occurs where cash flows into the market for reserves continuously exceed cash flows drained into the central bank. This can occur in any economy, but, historically, Soviet, wartime and transitional countries have been among the most prone to liquidity surpluses. Transitional economies, for example, often attract large capital inflows as the economy opens and undergoes privatisation. In the wartime economy, consumption is restricted and large amounts of involuntary savings accumulate until goods and services eventually become more widely available. Soviet-style economies have displayed widespread shortages and administered prices. This creates a situation of repressed inflation, whereby prices are too low relative to the money stock, leaving individuals with excess real balances. Clearly, the incidence of surplus liquidity is wide and may have important implications for both central bank policy and operations.²

The objective of the paper is to define carefully the way in which surplus liquidity arises, how far in practice this represents a problem for central banks and, if so, what the possible responses might be. The potential issues raised by surplus liquidity are threefold and concern:

- The transmission mechanism of monetary policy;
- The conduct of central bank intervention in the money market;
- The central bank's balance sheet and income.

Section 2 begins by considering the choices which determine the desired level of cash balances and how these can influence the transmission mechanism of monetary policy. Empirically, the main source of surplus reserves in recent years has been capital inflows of one sort or another, usually in the form of foreign direct investment or aid — and often into countries with fixed exchange rate regimes. The objective of section 3 is to discuss these underlying sources of liquidity and to illustrate them in terms of actual country experience. Sections 4 and 5 move on to cover the workings of the central bank balance sheet, and, in particular, the main factors in the supply and demand for central bank reserves. A thorough appreciation of the central bank balance sheet is fundamental to an understanding of surplus reserves. Central bank reserves are defined for practical purposes as domestic deposits held at the central bank by its main counterparties; and the “banking system” (or, more widely, the “market”) is taken to include all financial institutions that have access to central bank credit or which operate an account with the central bank. Section 6 discusses concepts of market balance and examines the effectiveness of central bank intervention in the presence of surplus

¹I would like to thank Bill Allen, Andrew Bailey, Spencer Dale, Andrew Dent, Simon Gray, Gill Hammond, Glenn Hoggarth, Lavan Mahadeva, Peter Sinclair, Gabriel Sterne and Nick Talbot for helpful discussions and suggestions. Dan Huynh and Sujay Shah provided enthusiastic research assistance. I must also thank staff in various central banks who contributed information on the liquidity experience in their countries. The contents of the paper are the author's responsibility alone, and no part of the paper may be taken to reflect the views of the Bank of England.

² Throughout, the terms “surplus reserves” and “surplus liquidity” will be used interchangeably. For convenience, the same applies to the terms “banking system” and the “market for reserves”.

liquidity. Section 7 outlines the main approaches to the sterilisation of surpluses and the costs that these may bring. Section 8 summarises the main themes.

2. Liquidity Choices and Monetary Policy

Section 2 discusses the influences which determine the level of liquidity the public will choose to hold. It considers what role liquidity plays in monetary policy and how far this could represent a policy problem for the monetary authorities. For example, in practice, what precisely are the risks of too much, or too little, liquidity? How might different levels of liquidity effect the transmission mechanism of monetary policy?

Monetary quantities are always likely to be of some significance for the central bank. For example, they are especially important in countries where measured interest rates contain little useful information on monetary conditions – because the financial markets are highly illiquid or market forces are not allowed to operate. In this case, data on stocks of liquidity may be the only firm financial information available. For this, if for no other reason, the levels of cash balances held in the economy will be a crucial data source for general economic surveillance and for policy analysis.

2.1. Microfoundations

The “desired” level of liquidity, at least from the central bank’s point of view, can be thought of as that level of reserves consistent with the monetary authorities’ policy targets – whether these are for the monetary aggregates, the exchange rate or inflation. Putting this more generally, it is possible to think of optimal liquidity as the outcome of the decisions of economic agents – of households, firms and banks. In particular, their balances are “optimal” if they are *willingly held in full* as the outcome of well-informed choices. If this is the case, the level of cash balances is likely to be less problematic for monetary policy purposes.

What might these optimal decisions on cash holdings look like? In the economics literature, Keynes distinguished the transactions, precautionary and speculative demands for holding money. Subsequently, these general determinants have been refined into more precise “rules” where cash balances for individuals and firms are said to be held in some specific ratio to the scale of their transactions — rather like velocity measures linking the monetary aggregates to GDP. Indeed, long ago, Edgeworth (1888) advanced the proposition that there are economics of scale for banks in their holdings of reserves.³

In broad terms, models of the banking firm have a common micro-foundation: they treat the bank as a rational investor which secures funds as deposits and invests these in a wide variety of interest-earning assets (loans). The bank’s basic decision problem is therefore one of portfolio allocation – that is, the optimal allocation of its funds (deposits) among various

³ This exemplifies the so-called square-root law of precautionary reserves. Using this terminology, the banks’ precautionary reserves grow with the square root of the number of transactions. See Olivera (1971) for more details. Analogously, Miller and Orr (1966) argued that, for non-bank firms, the same elasticity would be one third.

assets. Some models go further in attempting the optimal determination not only of the structure of assets and liabilities, but also of the total size of the bank's balance sheet.⁴

In practice, banks, households and firms may hold balances in excess of these optimal ratios – either voluntarily or involuntarily. Again, from the policy perspective, the central bank may be less concerned by the existence of surplus liquidity if it is willingly held. For example, some banks may choose to hold excess reserves as a signal of liquidity strength to their customers and to their (potential) owners. Excess reserves also provide insurance against the possibility of unexpected increases in reserve requirements or the possibility of unexpected cash withdrawals. These factors may be important for a young bank at an early stage of transition from state control. Surplus balances might also be held as part of a stock-adjustment process. If so, a surplus in flow terms may represent a simple upward adjustment towards a new stock equilibrium. This stock adjustment may not be long term — lasting possibly just a few months — so that the flow surplus would represent merely a liquidity management problem for the central bank, rather than a more significant issue in the monetary transmission mechanism.

On the other hand, at least some part of cash holdings may not be desired – that is, there may be “excess” reserves which are not willingly held relative to desired equilibrium balances. These excess cash balances may reflect unexpected surges in liquidity “imposed” through heavy government borrowing from the central bank, or through large capital inflows. Excess balances at the banks might also reflect poor liquidity management – either because of ineffective portfolio management by the banks themselves or because of an unpredictable payments infrastructure which hinders their attempts to control the structure of their balance sheets.

If some fraction of cash holdings are not held willingly, it becomes more likely that surplus reserves are problematic from a monetary policy point of view. For instance, the rapid accumulation of unwanted reserves could lead, if unsterilised, to monetary growth outside the central bank's target range. This may be reflected in higher domestic consumption and undesirable increases in inflation. It might also, in the first instance, lead to sharp and unsustainable increases in asset prices. Subsequently, if the increase in surplus balances is reversed – for example where temporary increases in inward capital flows are rapidly repatriated – this could lead to sharp asset price reductions and greater market price volatility overall.

2.2. The Transmission Mechanism and Surplus Liquidity

These effects clearly indicate that surplus liquidity has at least the potential to disrupt the transmission mechanism of monetary policy. Typically, three channels of monetary transmission have been identified: the interest-rate channel, the exchange-rate channel and, more recently, the credit channel. Various refinements and extensions of these can be found in the literature. In principle, surplus liquidity may play a role in all three. Quite how much is likely to vary by country and over time – and this includes the possibility that surplus

⁴ The classic references on the banking firm's liquidity choices are Klein (1971) and Baltensperger (1980). The changing influences on these choices are discussed in Chaplin, Emblow and Michael (2000).

liquidity may have no material influence at all on policy effectiveness in some countries, as has been the case in Hungary and South Africa for example.⁵

For illustrative purposes, consider the possible influence of surplus liquidity on the interest-rate channel. If there is effective monetary policy implementation, changes in central bank rates are fully and rapidly reflected in changes in inter-bank rates, then in the wider structure of rates in the banking system and, through this, in aggregate demand and inflation. This mechanism is usually underpinned by the existence of a liquidity shortage in the inter-bank market. This forces the market into transactions which allow the central bank to exploit its position as the monopoly supplier of domestic currency and in so doing to set the marginal price of the banks' liabilities.

With surplus liquidity, this transmission mechanism can break down or become weakened at an early stage. If the market is long in reserves, the central bank's counterparties will have discretion as to whether they lend their surplus reserves to the central bank. The central bank cannot force the banks to lend to it and so, to one extent or another, the central bank's ability to transmit its preferred interest rate into the market is weakened.⁶

Surplus liquidity may also have implications for the exchange rate – particularly in the event of a currency crisis. Excess balances may find their way into the foreign exchange markets if the public prefers to hold some of its liquidity in foreign currency. This will put (further) downward pressure on the domestic currency and could have knock-on effects on inflation. At the same time, in a situation of continuing surplus reserves, the central bank is a net debtor with the market and is likely to have problems refinancing its short-run borrowing. Its counterparties are unlikely to participate in these operations unless the central bank raises interest rates, both to make its refinancing possible and to prevent an even steeper depreciation of the currency.

How far these transmission problems “bite” is an empirical question. Some countries with surplus liquidity — for example the Czech Republic, Finland (before it joined the euro zone), Hungary and South Africa — have had no significant pass-through problems. By contrast, others with liquidity *shortages* have experienced monetary transmission difficulties. But it is often the case in transitional and developing economies, that there will be a larger range of financial market imperfections and data problems, complicating the identification of the channels of monetary transmission.⁷ For example, there may be greater asymmetric information and very limited intermediation through capital markets. Surplus liquidity is therefore one factor among many influencing the overall effects of monetary policy.

Moreover, in some countries, surplus liquidity will be symptomatic of benefits elsewhere in the economy. In so far as excess balances reflect rapid increases in foreign direct investment, they will have a positive impact on the capital stock and productive capacity. At the same

⁵ De Bondt (2002) provides an interesting and up-to-date survey of the many influences on interest rate pass-through; he examines the effect of changes in inter-bank rates on retail interest rates and concludes “the proportion of a given market interest rate change that is passed through within one month is found, at its highest, to be around 50%”.

⁶ A fuller discussion of the central bank's intervention with liquidity surpluses and shortages is provided in section 6.

⁷ Kamin, Turner and Van't dack (1998) and Mahadeva and Sinclair (2002) give an excellent overview of the problems involved in identifying the monetary transmission mechanism in emerging market countries.

time, increasing foreign ownership may have indirect benefits such as hastening the spread of best practice production techniques in the local economy.

3. The Main Sources of Surplus Liquidity

Where does surplus liquidity come from? And why might the banks willingly hold it? Historically, the immediate sources of surplus reserves were observed on the central bank balance sheet as large increases in either net foreign assets or in net lending to government. Underlying these changes, the following influences on liquidity can usually be identified:

- Foreign currency inflows linked to:
 - current account balance and the exchange rate;
 - capital account inflows, e.g. foreign direct investment, portfolio inflows, IMF credits and aid-related transfers;
- Monetisation of the fiscal deficit.

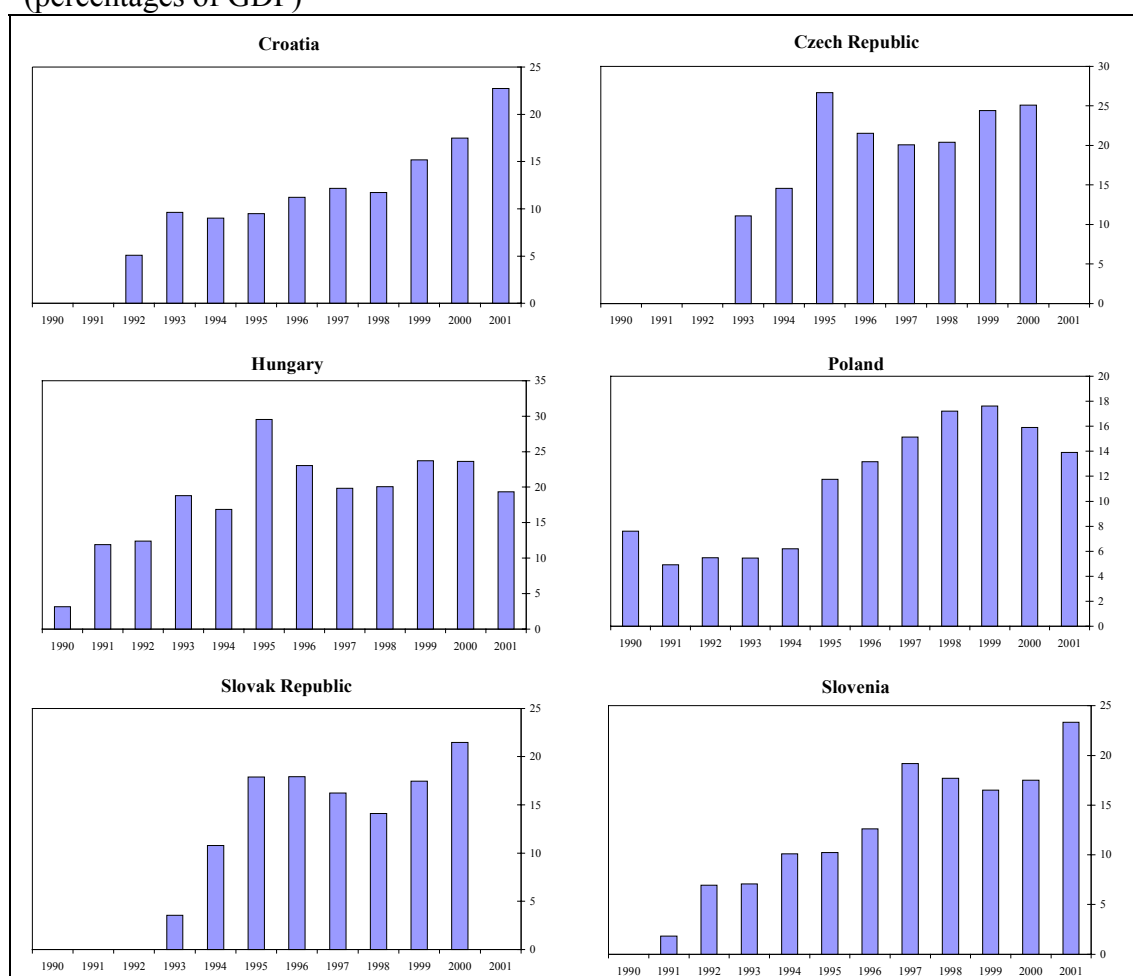
The objective of section 3 is to discuss each of these sources of liquidity and to illustrate them in terms of actual country experience. It also discusses infrastructure weaknesses in payment systems, inter-bank liquidity and market forces which can increase the banks' demand for reserves over-and-above the central bank's required reserves.

3.1. Current Account Balance and the Exchange Rate

In many countries, foreign currency inflows were probably the most important cause of surplus reserves in recent years. The underlying reason for these inflows varied from country to country. But, broadly speaking, inflows were linked to trade flows and the exchange rate, cross-border investment and speculation, payments of international aid and IMF credits.

On the trade side, increases in reserves usually arose where there was a sustained current account surplus and a fixed exchange rate. Some countries – for example big commodity exporters – may run large current account surpluses over extended periods. If the exchange rate is freely floating, it can be expected to appreciate over time making exports more expensive and gradually offsetting the current account surplus. In this case, the effect of the current account on liquidity is curtailed because the need for central bank intervention is very limited when the currency is floating. However, if the exchange rate is fixed and there is a prolonged current account surplus, the central bank will intervene to offset upward pressure on its desired parity. This intervention will be reflected in increasing flows of net foreign assets onto the central bank balance sheet. If there is no effective sterilisation, surplus reserves will accumulate in the banking system, as has been the case in Croatia and Poland for example. Table 1 illustrates the very substantial size of the increases in foreign currency reserves in some of the transitional economies of central Europe: in some cases the annual change in foreign currency reserves has amounted to 20% to 30% of GDP.

Table 1: Official Foreign Currency Reserves
(percentages of GDP)



Source: Lines 1d.d and 99b, country tables, *International Financial Statistics*, International Monetary Fund.

In commodity exporters like Botswana and Namibia, exports of minerals (especially diamonds) account for a very large share of exports. In Namibia, diamonds make up around 40% of export earnings and metals (including diamonds) for over 55%.⁸ Both countries peg their exchange rate to the South African Rand,⁹ so that upward pressure on the peg leads to intervention, increases in the central bank's foreign currency assets and, accordingly, to increases in domestic liquidity. Surges in liquidity may also result from less obvious sources in some countries. For example, in Croatia, inflows generated from tourism have had a material effect on surplus reserves of the kuna since 2000.

3.2. Capital Account Flows

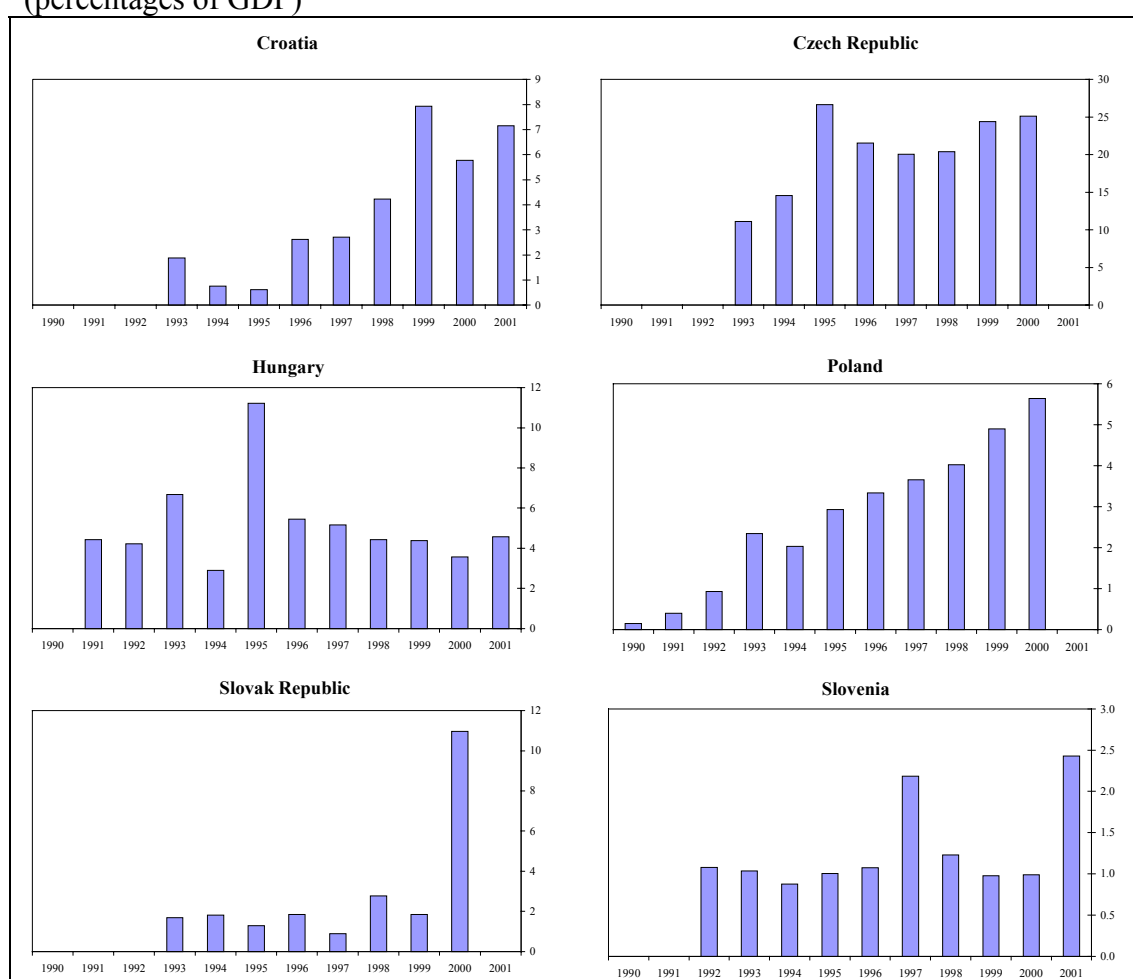
Flows through the capital account were a very significant source of surplus reserves, especially in the formerly Communist economies of central Europe. These flows were of various kinds, but one of the most important in countries like Slovenia was "equity" or foreign direct investment (FDI) by overseas residents to purchase or establish local

⁸ See *Africa Recovery*, April 1999, on www.un.org/ecosocdev/geninfo/afrec.

⁹ Botswana pegs the pula against a basket comprising the Rand and the SDR (with weights in proportion to trade).

production facilities. In many countries these flows were driven by improving sovereign and corporate credit ratings and large privatisation programmes to sell off state assets to the private sector. Privatisation has attracted large purchases from overseas residents and the resulting inflows were associated with significant injections of liquidity in many cases. Since January 2000, and largely as a result of the overseas proceeds of the government's privatisation programme, banks in the Slovak Republic have held excess balances amounting to around three times the central bank's required reserves.¹⁰ The importance of FDI can be seen in the data in Table 2. Again, the size of the flows involved can be very substantial, amounting to around a quarter of GDP in the Czech Republic for example.

Table 2: Foreign Direct Investment
(percentages of GDP)



Source: Lines 78bed and 99b, country tables, *International Financial Statistics*, International Monetary Fund.

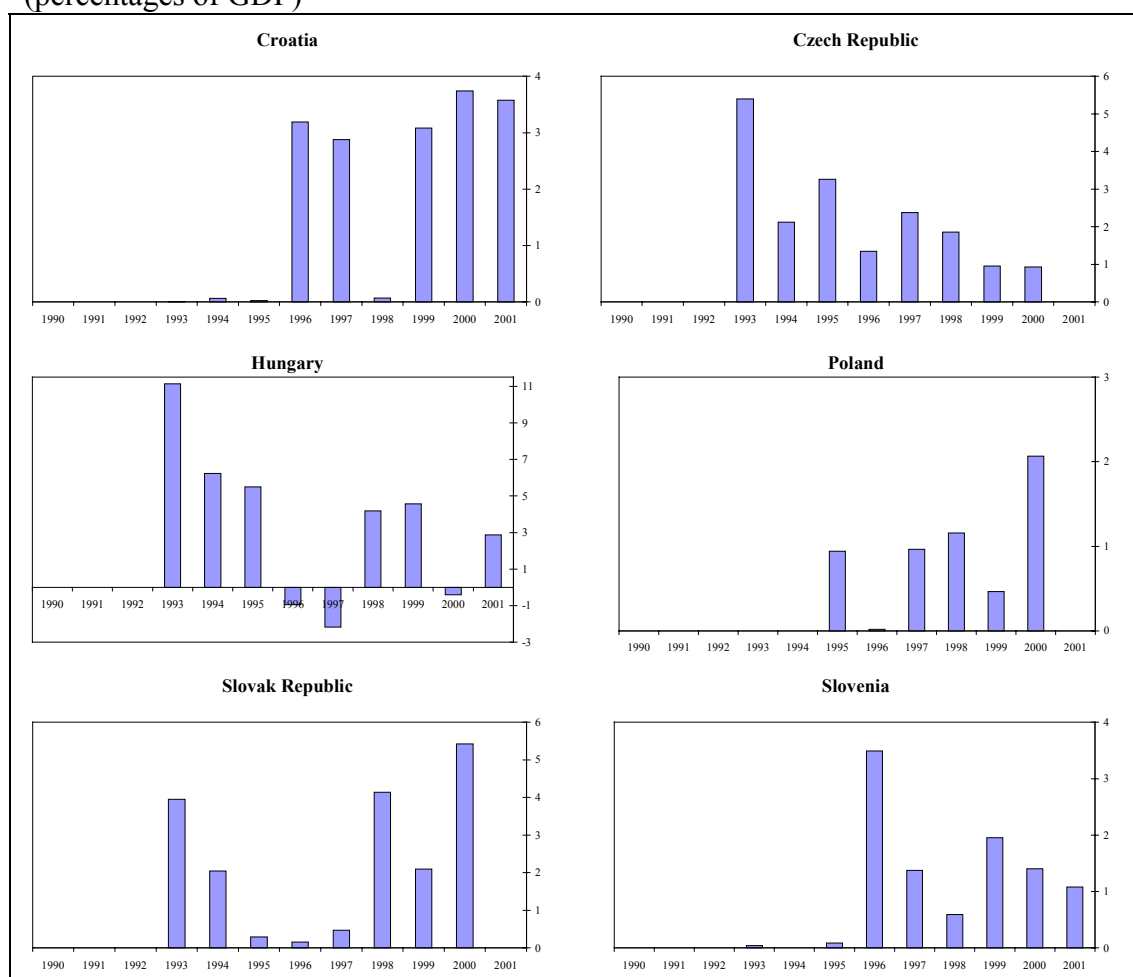
Table 3 illustrates portfolio inflows which have been a liquidity-creating factor in some countries, especially where there were large interest-rate differentials with the rest of the world. Somewhat greater volatility of portfolio flows is apparent when compared to changes in FDI. “Convergence trading” has been an important determinant of portfolio inflows in several of the European Union accession countries like Hungary. In this context, overseas investors have made large purchases of domestic financial assets (e.g. government bonds),

¹⁰ In principle, the *timing* of these sales is under the control of the authorities, so that they could attempt to defer the liquidity injection by delaying, or limiting the size of, privatisations.

driven by the anticipation of capital gains when these countries enter Economic and Monetary Union (EMU). To similar effect, governments and corporates have made foreign currency borrowings abroad at lower interest rates; finance ministry borrowing in Turkey and Croatia were examples in recent times. Often, however, the sterilisation cost of this borrowing to the central bank has offset the gains to the government.

The impact of equity and speculative inflows on liquidity has been heavily influenced by the exchange rate regime. A common story is again that of the transitional economies of central Europe. Most of these began the transition process in the 1990s with a fixed or managed exchange rate. On-going upward pressure on desired parities saw central banks intervene to sell large amounts of local currency. Over time, most of the countries concerned moved to more flexible exchange rate arrangements (e.g. a crawling peg or crawling bands), which has gradually curtailed this source of liquidity injection. A representative example is Poland, which by April 2000 had moved to a fully-free float without fluctuation bands.

Table 3: Portfolio Investment
(percentages of GDP)



Source: Lines 78b*gd* and 99b, country tables, *International Financial Statistics*, International Monetary Fund.

An important consideration here is that capital inflows may eventually lead to offsetting liquidity withdrawals. For example, successful FDI projects initially inject liquidity, but will sooner or later lead to liquidity-reducing dividend outflows. Likewise, overseas borrowing

must be serviced and speculative trades on interest differentials will “mature”. Thus, over periods of several years, some liquidity inflows may be balanced by corresponding outflows, so that over time there is no net liquidity creation from these particular sources.

3.3. IMF Credits and Aid

In the poorest nations, transfers through the capital account in the form of overseas aid often become a significant influence on domestic liquidity. A good example of this is the joint IMF/World Bank debt relief initiative for Highly Indebted Poor Countries (HIPC).¹¹ First proposed in 1996, this is currently in operation in 42 countries world wide and is designed to reduce their debt burden to sustainable levels¹² — with a *quid pro quo* that this frees government resources for infrastructure investment, usually in health, education and sanitation projects. Mozambique makes an interesting example. Its GDP in 2000 was \$3.8 billion. By comparison, the country’s HIPC debt relief package announced in April 1998 translated into debt service relief over time of nearly \$3.0 billion (i.e. almost 80% of GDP). Subsequently, the floods in 2000 and 2001 which devastated the country brought further large aid transfers to Mozambique. These latest transfers and the debt relief initiative have allowed increases in government investment spending which has created excess liquidity equivalent to outstanding purchases of Treasury and central bank bills of around \$125 million. A similar chain of events is evident in many other HIPC countries like Uganda, where regular aid from donor countries averages 10% of GDP, and sometimes rises to 15% or more. In principle, however, aid flows differ from capital inflows like FDI, because they do not imply any future capital outflows which offset the initial increase in domestic liquidity (although this conclusion may depend on how the aid monies are used).

Analogous experience can be identified in many countries, sometimes in the wake of unexpected financial crisis. In Turkey, for example, take-up of emergency IMF credits granted in the wake of refinancing difficulties generated substantial excess liquidity in 2001. The crisis involved recapitalisation of the banks and monetisation of the fiscal deficit, financed through IMF credit (see Serdengeçti (2002)).

3.4. Lending to Government

The central bank’s relationship with its government will be an important one. Ideally, the government’s fiscal deficit will be funded by borrowing from the private sector, probably in the form of bond sales. Where this source dries up, the central bank may be asked to lend to the government. These loans to the government are often referred to as “monetisation” of the deficit. Szpunar (1998) and Grabowski (1999), for example, document the contribution of central bank deficit financing to surplus liquidity in Poland in the 1990s; while Altinkemer (1994) covers similar experience in Turkey. Historically, this has in some countries been one of the main causes of surplus liquidity. In countries with independent central banks, however, deficit monetisation may be forbidden by law. European Union countries, for example, are forbidden to borrow from their central banks by the Treaty of Maastricht.

¹¹ Details of the HIPC initiative can be found at www.worldbank.org/hipc/about/about.html.

¹² 34 of the HIPC countries are located in Africa, 4 in Latin America, 3 in Asia and 1 in the Middle East.

3.5. Financial Infrastructure and Market Forces

Weaknesses in the financial infrastructure and in market forces – either directly, or in combination with influences from the central bank balance sheet – can be a factor which will raise the demand for reserves above levels required by the central bank. These weaknesses can take a number of forms and are relevant in situations of both reserves surplus and shortage. Di Giorgio (1999) argues that the level of financial development can be summarised in terms of the costs of participation in financial markets. In financially-developed economies, the costs of processing information, evaluating projects and monitoring borrowers are relatively low. This makes it easier for the banks to manage their liquidity and, *ceteris paribus*, reduces their demand for reserves.

But countries with slower and less predictable money payment and securities settlement systems will often face higher financial participation costs and poorer inter-bank liquidity. These will make it more difficult for the banks to manage their balance sheets, as they will have less certainty when large payments on their books will be completed. The on-going possibility of unexpected swings in reserves will induce the banks to hold higher precautionary balances at the central bank. As is the case in Lithuania, the level of precautionary balances will usually be higher for the smaller banks who have less diversified — and therefore more volatile — balance sheets. Consequently, some of the smaller banks there hold excess reserves equal to more than 100% of required reserves. (The average excess reserves for the banking sector as a whole in Lithuania were around 18 ½% of required reserves in the first half of 2002.) It follows that if there is consolidation in the banking industry leading to the merger of many of the smaller banks, this should reduce the sector's overall holdings of precautionary reserves (as the larger banks reap economies of scale in their reserve holdings).

To offset these effects on reserves, the central bank can promote the introduction of newer, more predictable infrastructure capable of providing same-day settlement and delivery *vs.* payment for securities transactions. These improvements in the financial infrastructure should allow the banks to economise on precautionary balances at the central bank. Petrov (2000) suggested that in European Union accession countries like Bulgaria, improvements in the banks' liquidity management could be achieved through accelerated access to TARGET – the euro-zone Real-time Gross Settlement (RTGS) system.

Market forces will be an important factor in both the secondary inter-bank market and in the primary market for central bank money. In either case, the central bank will want to encourage greater competition among counterparties. If these markets are concentrated around a few key players, the central bank is likely to lose some of its monopoly power in price setting so that interest rate pass-through to commercial bank balance sheets may be restricted.

Market forces in the retail banking market will also be an important factor influencing the demand for reserves and interest rate pass-through. This again is more likely in situations where the banking system is concentrated around a small number of dominant institutions, as has often the case in formerly Communist economies. In this kind of situation, the National Bank of Poland decided to introduce deposit accounts for the general public in the mid-1990s (Szpunar (1998)). The objective of these was to stimulate competition for central bank funds via the retail market. It may also be possible to increase competition directly in the market place by allowing foreign participation in the provision of banking services and, indirectly, if

the authorities are able to promote non-bank forms of financial intermediation. In principle, as capital markets for equities and bonds grow this should force the banks to compete more aggressively for funds, and, in so doing, make their interest rates more responsive to changes in the central bank intervention rate. In many countries, responsibility for market development is shared between the central bank, the finance ministry and regulatory bodies. This means that the ability to promote competition and better infrastructure in local financial markets may not be fully within the central bank's sphere of influence; in any case, changes to market infrastructure and competition will usually be a gradual, longer-run process.¹³

3.6. Currency Boards and Liquidity

It is worth observing that a small number of countries – Bosnia and Herzegovina, Brunei, Bulgaria, Djibouti, Estonia, Hong Kong, Lithuania and Macao among them – operate a Currency Board system, rather than a fully-fledged central bank. Bie and Hahnemann (2002) argue that in these countries both the Board and the commercial banks will wish to hold surplus reserves – albeit in foreign currency form, but convertible at short notice into local currency.

The key function of the Currency Board is the note issue – its main liability – on which it retains seignorage income. Typically, these liabilities are backed, at least one-for-one, and at a fixed exchange rate, with holdings of a reserve currency and gold. The main determinant of the stock of domestic liquidity will be inflows and outflows of the reserve currency – usually US dollars or euros. Clearly, Currency Board systems are vulnerable to deflationary external shocks which unexpectedly withdraw the reserve currency. In this context, the Board does not have the normal discretion of a central bank to add reserves through Open Market Operations – effectively the Currency Board has no monetary policy of its own and very short-term interest rates are market determined, often with high volatility. The Board may only add new liquidity in so far as it holds surplus amounts of the reserve currency which it can use to match the creation of new liabilities. For this reason, Boards will hold excess amounts of the reserve currency in a ratio of at least 1.1 to local currency to provide a buffer against external shocks (see Bie and Hahnemann (2002); Ghosh *et al* (2000)).

A key distinction of the currency board system is that there is no domestic monetary policy and so, as such, the interest rate pass-through question doesn't arise. In this context, monetary policy signals derive from the policies of the reserve currency central bank and the domestic liquidity situation does not influence the transmission mechanism. As can be observed in Lithuania, for example, longer-term money market rates are correlated with long rates on the anchor currency (in this case the euro).

4. Supply of Central Bank Reserves

A thorough appreciation of the workings of the central bank balance sheet is fundamental to an understanding of the way in which surplus reserves arise in practice. Consequently, sections 4 and 5 now move on to cover the principal components of the central bank balance

¹³ Plenderleith (2001) gives an interesting overview of the central bank's role in promoting financial markets.

sheet, and in particular the main factors in the supply and demand for central bank reserves to the market. This allows a proper analysis in section 6 of central bank intervention in the contrasting situations of liquidity shortage and surplus.

Consider Table 4 which depicts a stylised central bank balance sheet. For simplicity this nets the external position of the central bank and its position against the government, so that they appear on one side only. There are 4 main “autonomous” supply components to central bank reserves: net foreign assets (which includes holdings of foreign currencies, gold and of foreign-currency denominated securities), net lending to government, domestic currency in circulation and “other” items (net). Day by day, these factors will usually fluctuate to reflect either an inflow or an outflow of reserves to the market. “Autonomous” in this context means that these factors are usually beyond the control of the central bank in the very short run.¹⁴

Table 4: Balance Sheet of the Central Bank

<i>Assets</i>	<i>Liabilities</i>
Net foreign assets	Cash in circulation with public
Net lending to government	Required bank reserves
Net other items	Free bank reserves
Net market lending	

4.1. Net Foreign Assets

A key influence on liquidity is changes in the central bank’s net foreign assets (“NFA”). This will depend upon the authorities’ exchange rate regime and balance of payments fluctuations. In a fixed exchange rate country, or in one with a managed float, the central bank may be forced to intervene on the foreign exchanges to maintain a parity or target range for the domestic currency. If there is downward pressure on the parity then, with non-sterilised intervention, it acquires domestic currency in exchange for net foreign assets, resulting in a reduction in the monetary base. The central bank is generally able to neutralise this effect on the monetary base by engaging in an offsetting transaction which injects domestic currency liquidity into the market to coincide with the drain of liquidity caused by the intervention. The sterilisation transaction will usually be a purchase of domestic financial assets like government bonds. In the very short run, variations in net foreign assets at some central banks are known with certainty, since settlement cash flows in foreign exchanges typically lag transactions by up to two days. In countries with a freely floating exchange rate, there is generally no intervention and so no change in the central bank’s net foreign assets, other than for revaluation effects.¹⁵

4.2. Net Lending to Government

A second potential factor in the creation of reserves is net lending to government (“NLG”); this accrues through the net daily cash flows in and out of the consolidated fiscal account at

¹⁴ In practice, the parts of the balance sheet the central bank can control reflect the policy targets which are in operation. As should become clear, with an exchange rate target, the central bank cannot control the level of its foreign exchange reserves. But if there is no target, and the central bank does not intervene for other reasons, then this part of the balance sheet becomes controllable.

¹⁵ If the central bank is allowed to keep revaluation gains or losses, they will not create a cash flow with the market. But if gains are distributed to the government, they will constitute an additional cash inflow.

the central bank. In terms of the size and volatility of the flows involved, this account may have a substantial effect on the supply of reserves (both in countries with reserve shortages and with reserve surpluses). In the euro area, for example, government deposits are the most volatile component of the central bank balance sheet.¹⁶ But, as is well known, the euro area has a persistent reserves shortage. In Lithuania, a surplus reserves country, the volatility in central bank liquidity is, likewise, heavily influenced by fluctuations in government deposits. These fluctuations have increased substantially since the second half of 2001, when the consolidated government account was moved out of the banking system into the Bank of Lithuania.

But the likely reasons for volatility in the government accounts are varied. Flows of government spending and tax revenue may be highly seasonal. Tax revenues often surge around the end of corporate accounting years – typically in January. *Ceteris paribus*, a very large inflow of this type will result in a fall in net lending to government. Likewise, on days when the government makes very large payments which are not offset by revenues, the consolidated fiscal account will move into deficit. If it is allowed to, the central bank will lend to the government to make up the difference.

In some countries – for example European Union signatories to the Treaty of Maastricht – there is now legislation forbidding central bank lending to government. But in countries without this kind of safeguard, the central bank may be required to lend to government if its deficit is not fully funded out of taxation, bank borrowing or debt sales. If this lending is not fully offset (sterilised) by corresponding withdrawals of liquidity from the market, the central bank balance sheet will keep growing if the fiscal deficit persists. There will be an on-going injection of reserves.¹⁷

4.3. Cash in Circulation

Domestic currency in circulation (“Cash”) is a further autonomous factor in reserves supply. It is defined as all central bank notes held outside the central bank. Decreases (increases) in the outstanding note issue imply credits (debits) to the banking system’s accounts with the central bank; in other words, decreases in the note issue add to central bank reserves. Changes in the note issue can be volatile on a daily basis, but often have some predictable seasonality, both within-week and within-month. For example, the commercial banks will supply large quantities of notes to the public on a Friday for weekend spending, on payroll dates and prior to public holidays. In some economies, for example in Spain, the summer tourist season usually brings about large temporary increases in cash circulation. Although less predictable than regular seasonality, sudden changes in public confidence may also lead to swings in note circulation. If public confidence in the currency collapses, the economy may dollarise, whereby households and firms switch large holdings of domestic currency into US dollars (or euros). Equally, of course, an improvement in sentiment may lead to a de-dollarisation and a rapid increase in circulation of the domestic currency – as has happened in Yugoslavia for example after public confidence in the dinar returned during 2001.

¹⁶ See European Central Bank *Monthly Bulletin*, pp. 14-16, July, 2001. A more general review of the factors affecting the balance sheet of the Eurosystem can be found in “The liquidity management of the ECB”, European Central Bank *Monthly Bulletin*, pp. 41-52, May, 2002.

¹⁷ Cottarelli (1993) considers how central bank credit to government can be regulated and how constraints on lending can be implemented. Petrov (2000) suggests the finance ministry should publish a clear calendar for expected government outlays.

As the increase in the note issue can be substantial, it is often a significant factor in the creation of reserve shortages in the banking system. Likewise, when large quantities of spent notes are returned to the banks (e.g. on Mondays or after public holidays), there is frequently a tendency to surplus reserves. The main long-run determinants of currency demand are transaction variables such as GDP or private consumption and opportunity cost measures like interest rates or inflation. The usefulness of these data to the central bank as a guide to currency demand will depend on technological and financial innovations – like the introduction of ATMs and e-banking – and the use of parallel currencies. The proportion of transactions financed by cash is declining slowly in most countries. But given there is some inflation and growth in the economy, the size of the note issue usually rises over time in absolute terms. On the other side of the balance sheet, an asset such as the stock of central bank refinancing will usually be allowed to rise broadly in line to match the central bank’s growing domestic currency liabilities.

4.4. Other Items

A fourth autonomous supply factor can be summarised as “net other items” (“Other”) and includes the central bank’s capital and reserves. This is perhaps the least volatile of the autonomous components of liquidity and comprises principally retained profit over time – which is usually invested in high-quality, liquid assets like government bonds, short-term deposits with high-credit banks and, sometimes, in AAA private-sector bonds.¹⁸ Transactions in capital and reserves are normally known well in advance. Depending on the institutional arrangements, other items may also include the so-called “reserve float”. This arises if transactions with the banking system are not debited and credited on the same day on accounts at the central bank: in practice, the central bank may make credits a day or two before debits and bank reserves are created as a result of this time lag.

4.5. Net Market Lending

A final and pivotal component in the supply of reserves is the central bank’s net market lending (“NML”). This can be written:

$$\text{Net market lending} = \Delta OMO + \Delta SF + \Delta Mature \quad (1)$$

where “ Δs ” indicate cash flows.¹⁹ ΔOMO is new borrowing or lending with the market in the central bank’s open market operations, and ΔSF is the net liquidity injection through use of the central bank’s Standing Facilities. (Use of Standing Facilities is, of course, at the discretion of the banks themselves.) $\Delta Mature$ is the change in the outstanding stock of refinancing as previous lending through OMOs and SFs becomes repayable. For example, if the central bank is a net creditor (debtor) of the market, $\Delta Mature$ represents a withdrawal (addition) of reserves as the central bank’s previous operations mature. *Once transactions with the market have been undertaken, they are, as such, a bygone;* and so maturing lending between the central bank and the market can be considered a further autonomous source of reserves – in the sense that, once made, it is outside of the control of the central bank. Moreover, maturing lending differs from the other autonomous sources of reserves in that it

¹⁸ The precise allocation of investments will reflect the central bank’s attitude to risk.

¹⁹ This description of lending to the market by the central bank is not exhaustive. In practice, the instruments used by central banks will reflect policy choices and the constraints imposed by market structure and the level of market development.

should be predictable with certainty: the market knows what it has already borrowed from the central bank.

Based on the balance sheet identity in Table 4, and following Borio (2001) and Schaecter (2000), the supply of reserves can now be defined as the sum of changes in the market's "autonomous liquidity position" and the central bank's "policy position":

$$\text{Supply of reserves} = \Delta NFA + \Delta NLG + \Delta Other - \Delta Cash + \Delta Mature + \Delta OMO + \Delta SF \quad (2)$$

The first five items, $(\Delta NFA + \Delta NLG + \Delta Other - \Delta Cash + \Delta Mature)$, are the market's "Autonomous Liquidity Position" and $(\Delta OMO + \Delta SF)$ is the central bank's new lending or "Policy Position" in the market.

Since the components of actual central bank balance sheets vary, the change in the autonomous liquidity components can be written more generally as:

$$\sum_i \Delta S_i^A$$

where ΔS_i^A is the flow of the i th autonomous liquidity source on the central bank balance sheet; and so the total supply of reserves, including the central bank's policy position, is:

$$\sum_i \Delta S_i^A + (\Delta OMO + \Delta SF) \quad (3)$$

To summarise, then, the total supply of central bank reserves includes changes in the market's autonomous liquidity position plus changes in the central bank's policy position.

Borio (1997) reports data giving a breakdown of the net autonomous liquidity position in industrialised countries. These are shown in Table 5 for flows of net foreign assets, net lending to government, cash in circulation and other net assets (defined as a residual).²⁰ The data indicate that in practically all countries the note issue tends to absorb reserves, as it increases over time. In terms of variability, net lending to government appears to be the most volatile component in a majority of cases. The influence of net foreign assets is high in some of the economies with strong exchange-rate commitments – notably in those countries which at that time were in Europe's Exchange Rate Mechanism.

²⁰ The figures in Table 4 should be interpreted with some caution, since the incidence of measurement problems – such as valuation effects – varies across components. The influence of net foreign assets is especially difficult to measure as central banks are sometimes reluctant to reveal information about their foreign exchange market intervention. Moreover, in some cases the figures do not accurately reflect "normal" market conditions, owing to speculative attacks on the currency which will have generated exceptionally large changes in net foreign assets.

Table 5: Autonomous sources of reserves

	Net foreign assets		Net lending to government		Other net assets		Cash in circulation		Memo: Standard deviation ¹			
	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95	Net foreign assets	Net lending to government	Other net assets	Cash in circulation
Australia	-0.83	0.90	7.07	5.98	-7.15	-8.62	-0.44	-0.48	3.6	7.6	7.6	2.2
Austria	1.13	0.71	0.03	-0.01	-0.36	-0.10	-0.37	-0.31	2.6	0.1	1.2	1.7
Belgium	-0.53 ²	0.18 ²	-0.01	0.01	0.01	0.06	-0.08	-0.10	3.0	0.7	0.6	2.5
Canada	-0.82	0.54	9.52	-0.33	-7.45	-1.44	-0.46	-0.23	5.5	9.0	6.7	3.9
France	-1.90	1.77	-1.65	2.02	-0.61	0.37	0.04	-0.11	20.0	19.1	4.4	2.8
Germany	0.71	0.24	0.09	0.10	-0.24	-0.42	-0.58	-0.36	4.1	1.5	1.5	1.3
Italy	-0.91	-0.01	-0.02	-0.34	-0.32	-0.17	-0.27	-0.22	3.0	7.3	0.8	1.6
Japan	0.21	0.70	0.57	-1.36	-	-	-0.19	-0.47	1.0	6.3	-	6.8
Netherlands	2.60	-0.18	-0.88	-1.50	0.19	0.70	-0.04	-0.07	6.9	8.9	2.1	1.0
Spain	-0.34	-0.85	-1.88	0.90	-0.92	0.38	-0.51	-0.55	4.4	8.1	10.0	1.9
Sweden ³	3.93	-0.22	3.91	1.27	0.13	2.07	0.02	-0.05	21.3	40.3	11.1	3.9
Switzerland	0.84	0.49	-0.38	0.15	-0.94	0.02	-0.07	-0.08	1.8	4.1	4.1	2.2
United Kingdom	-1.22	-0.09	-2.39	5.46	1.53	-0.74	-0.66	-0.56	6.3	14.9	8.9	5.8
United States	-0.08	0.01	0.03	0.02	0.01	-0.01	-0.68	-0.57	0.2	0.5	0.2	0.5

Average monthly changes as a percentage of the average level of currency and bank reserves

¹For the period 1992-95. ²Including foreign exchange swaps used to adjust domestic liquidity. ³Owing to changes in operating procedures, especially in 1994, the series are not homogeneous.
Source: Borio (1997).

5. Demand for Central Bank Reserves

If the central bank operates with reserve requirements, the demand for reserves can be divided into two components, changes in Required Bank Reserves and changes in Free Bank Reserves:

$$\text{Demand for Central Bank Reserves} = \Delta RBR + \Delta FBR$$

Free bank reserves (“FBR”) are deviations from the required reserve holdings (“RBR”) on accounts at the central bank. Surplus reserves are sustained positive deviations from required bank reserves; that is, surplus liquidity reflects prolonged increases in free bank reserves. It will be helpful later to use the following notation for reserves:

$$\text{Demand for Reserves} = \sum_j \Delta D_j$$

where ΔD_j is the banks’ j th demand for reserves.

In this context, Borio (2001) argues that there are three factors on which the demand for commercial bank reserves depends:

- (1) the characteristics of reserve requirements; in particular, whether there is averaging and the length of the maintenance period;
- (2) the design and operation of the money payments system; and
- (3) the terms of access to central bank credit; principally, the incentives created for banks by the penalty structure for access to central bank funds.²¹

5.1. Required Reserves

If required to do so for monetary policy purposes, the banks will hold a proportion of their deposit liabilities at the central bank in either remunerated or unremunerated form. Obviously, these “required bank reserves” are more costly to the banks if they are unremunerated. If the central bank chooses to pay a rate of return to the banks this can be at a market or sub-market rate of interest. The cost of required reserves will also depend on their coverage, namely how much of the banks’ liabilities are actually included. For example, they may or may not include foreign currency liabilities; or, the central bank may choose to exempt liabilities over a certain maturity, say two years for example. Thus, the size of these holdings is determined by the central bank and varied from time to time when the authorities wish to adjust monetary conditions. For example, an increase (decrease) in required reserves will reduce (increase) the liquidity of the banking system. In practice, however, there may be limits to the frequency with which reserve requirements can be changed, and so fine tuning of short-term swings in liquidity will have to be approached in a different way. The advantage of reserve requirements as a liquidity device is that they require little in the way of infrastructure to implement. The central bank needs timely information on the size of banks’

²¹ There may be other factors relevant to the demand for reserves including the size distribution and concentration of the banking system: smaller banks, for example, may choose to hold relatively higher precautionary balances as they may have poorer access to the inter-bank market.

balance sheets, but with modern monetary instruments there is no need for a liquid inter-bank market as such.

5.2. Free Reserves

The central bank holds accounts containing the working settlement balances of the commercial banks. These accounts will be used by the banks as a buffer to cover unforeseen changes in the supply of central bank money. Since these deposits are held at the discretion of the banks, they are known as “free” or “excess” reserves. The settlement banks usually prefer to have accounts at the central bank because this gives them direct access to the ultimate source of domestic liquidity and the reduced credit risk in settling in central bank money;²² importantly, the central bank is also viewed as a neutral, non-competitive market participant. The central bank will not usually pay interest on these working balances, so ending the day with positive working balances means the bank incurs an opportunity cost equivalent to the overnight interest rate. If free reserves are unremunerated, the banking system’s demand for reserves will, in principle, increase when interest rates decline, and decrease when they rise – reflecting the interest elasticity of demand for reserves. This elasticity will also depend upon institutional arrangements, in particular whether there are averaging provisions and the length of the maintenance period for reserve requirements. Reserve requirements with averaging act as a stabiliser or buffer against which the banks can draw to meet settlement needs – at least early in the maintenance period.²³ If there are no averaging arrangements, the banks have much less daily flexibility in the amount of reserves they may hold. As a result, reserve requirements without averaging will make the demand for reserves more inelastic compared to a system with averaging. This suggests that the more flexible situation of reserve requirements with averaging calls for less active day-to-day management of liquidity by the central bank (Schaechter (2000)).

5.3. Payments Technology

The main reason a bank willingly holds these costly balances is precautionary because, to one degree or another, settlement banks will always have imperfect knowledge of their incoming and outgoing payment flows. In some countries, the operation of money payment systems is unreliable, so the banks may choose to hold a relatively large buffer of reserves to help them manage their liquidity. As technological advances speed up the payment system and make it more reliable, the banks can begin to economise on these balances. Improved system performance allows the banks to make a greater number of payments for the same (or lower) free balances. Petrov (2000) argues that the efficiency of the payment system can be measured by the ratio of the volume of payments made over the system to working balances. In the US federal funds market, for example, banks active in the payment system typically send and receive payments whose value is around 30 times greater than their overnight reserve balances; the very largest banks typically have a ratio of payments to balances of nearly 200 (Furfine (1998)). But as long as payment uncertainties persist, the banks will wish to avoid the risk of incurring a penalty over the market rate owing to an inability to meet their settlement obligations out of existing balances at the central bank. This penalty may take the

²² The arguments for settling money payments in accounts at the central bank – rather than on accounts at commercial banks – are covered in more detail in Bank of England (2000a).

²³ Hamilton (1996) develops a model with similar implications on the timing of reserve holdings. He shows that reserves held on different days of the week are not perfect substitutes, reflecting institutional features of the (U.S.) market which alter the cost of free reserves according to the day of the week.

form of premia on overnight rates in the market or a penal interest rate charged by the central bank in lending through its overnight Standing Facility.

5.4. Central Bank Credit and the Incentive Structure

In addition to the characteristics of reserve requirements and the operation of the payment system, a third factor influencing the demand for reserves will be the terms of central bank assistance. If there is any uncertainty in the market about the terms under which the banks can access central bank credit, they will insure against this by holding higher working balances. This could arise for a variety of reasons, linked for example to ambiguities in policy announcements, or legal and technical uncertainties in documentation. To similar effect, the central bank may be intervening with relatively illiquid or inefficient monetary instruments. In Mauritius, for example, the introduction of new repo and Standing Facilities in December 1999 led to the reduction of excess balances. Prior to this date, if they could not settle in the inter-bank market, banks had to transact with the Bank of Mauritius at very penal rates.

Wider aspects of banking regulation may also have an impact. For example, the existence of a deposit insurance scheme may lead the banks to hold lower precautionary reserves (compared to a situation with no insurance). Clearly, the generosity of the scheme and how it is funded will influence how far the banks decide to cut their working balances.

If perverse incentives increase the demand for precautionary balances, the ability of the central bank to influence interest rates may be weakened. The banks can use their surplus reserves to finance new lending, without having to obtain refinance from the central bank. At various points in the business cycle, the banks can adjust their surplus balances up or down in anticipation of changes in loan demand by firms. If companies' loan demand is stochastic, there is an unpredictable element in precautionary reserves as well. Hence the central bank needs to have a view of the level of reserves demand consistent with the monetary authorities' wider goals for monetary growth, inflation, etc. This view should be reflected in the quantity of reserves the central bank is prepared to supply to the banking system over the longer run. For example, if an increase in the growth of reserve money proved lasting and this was expected to result in higher inflation (implying no offsetting reduction in velocity), the central bank may increase its intervention rate in order to reduce both reserve holdings and inflationary pressures.

Given these influences on reserves, the question now arises whether the *marginal* demand for reserves is a demand for working balances or for required reserves. Borio (1997, 2001) argues that there are two preconditions for the marginal demand to be reflected in required reserves. First, it must be possible to use required reserves balances to meet settlement needs, allowing the banks to substitute them for free reserves (and thereby to economise on total central bank reserve holdings). This is equivalent to required reserves averaging. Second, the amount of reserves banks need to hold to comply with the reserve requirement should exceed their working balances targets, so that there is no separate residual demand remaining for settlement purposes. However, towards the end of the maintenance period, the banks will have to stop using required reserves as a payments buffer, in order to offset their cumulative reserve position and hit the average required reserves target. In this situation, the banks cannot rely on required reserves to meet settlement needs and the marginal demand will become a demand for working balances. At this point in the maintenance period, free reserve

balances are over-and-above those held as required reserves.²⁴ In terms of the central bank balance sheet identity in Table 4, the marginal change in the banks' discretionary working balances will be equal to:

$$\Delta FBR = \Delta NFA + \Delta NLG + \Delta Other - \Delta Cash - \Delta RBR + \Delta NML \quad (4)$$

That is, variations in free reserves will reflect shocks to autonomous liquidity flows and the demand for required reserves together with changes in the central bank's net market lending. In practice, the level of free reserves differs substantially among countries. In industrial countries they account for less than 1% of the monetary base, while in a number of emerging markets they can be much higher – reflecting periods in which direct monetary policy instruments have been used (Schaechter (2000)).

6. Liquidity Balance and Monetary Policy Implementation

Now that the building blocks of supply and demand are in place, section 6 will clarify the meaning of surplus reserves in terms of *ex ante* balance, before going on to consider the central bank's role in equilibrating the market for *ex post* balance. It explains how central bank intervention differs according to whether the market for reserves is in surplus or deficit and the issues arising in the surplus situation.

6.1. Market Balance Concepts

On a day-to-day basis, autonomous cash flows to and from the central bank are erratic and usually unbalanced, reflecting the volatility of large items on its balance sheet such as the note issue and fiscal flows. Generally speaking, therefore, reserve flows in and out of the market are unbalanced:

$$\begin{aligned} & (\text{Autonomous reserve injections } \textit{less} \text{ Autonomous reserve withdrawals}) \\ & \Rightarrow \text{Autonomous Liquidity Imbalance} \end{aligned}$$

Clearly, the liquidity imbalance can go in two directions. Where flows into the central bank exceed flows into the market, the banking system experiences a shortage of reserves, relative to demand; that is, the market experiences an autonomous deficit. Analogously, where flows into the market exceed flows to the central bank, the banks will hold excess reserves relative to their demand creating an autonomous market surplus. (In this context, “demand” is a flow and means the *change* in working balances at the central bank). Although the autonomous market balance may swing between surplus and shortage, most markets will display a persistent tendency in one direction to either surpluses or shortages of reserves. This on-going imbalance is known as the “structural” liquidity position of the market.

²⁴ Borio (1997) has also noted more generally “the marked international trend towards a reduction in reserve requirements over the last decade”. This reflects the inclination of many central banks to reduce tax-like distortions in the operations of the banking system.

Borio (1997, 2001) argues that it is useful to distinguish between the structural or “*ex ante*” balance and the “*ex post*” balance. *Ex ante* balance can be thought of as the expected *imbalance* before central bank intervention. This is the market’s structural liquidity position and reflects the net effect of the autonomous liquidity factors on the market. *Ex post* balance is the equilibrium balance achieved after central bank intervention and reflects the combined impact on the market of the autonomous liquidity factors plus central bank borrowing or lending (the policy position). That is:

$$\begin{aligned}
 \text{Ex ante imbalance} &= \text{Autonomous Supply Sources} + \text{Demand} \\
 &= \sum_i \Delta S_i^A + \sum_j \Delta D_j \neq 0
 \end{aligned} \tag{5}$$

Except by chance, the autonomous flows in the market will rarely net out to zero. If the imbalance in these flows is positive (negative) there is a surplus (shortage) of reserves. If the central bank acts to remove this imbalance, then:

$$\begin{aligned}
 \text{Ex post balance} &= \text{Ex ante balance} + \text{Central Bank Policy Position} \\
 &= \left(\sum_i \Delta S_i^A + \sum_j \Delta D_j \right) + \Delta OMO + \Delta SF = 0 = \text{“market balance”}
 \end{aligned} \tag{6}$$

The key difference between (5) and (6) is that the central bank’s intervention in the market seeks to offset the *ex ante* imbalance by adding or withdrawing reserves such that liquidity flows overall are matched in both directions. The central bank therefore plays an equilibrating role in balancing flows in and out of the market; and so *ex post* balance will be the equilibrium achieved after central bank intervention. This means that the central bank’s policy position equals the *ex ante* balance with the sign reversed. Note that it is of course possible that the *ex ante* balance may equal zero, where autonomous flows net off exactly. In this case, no central bank intervention is required and the *ex ante* and *ex post* balances are equal. But this is unlikely in practice, since the central bank will usually attempt to maintain a large outstanding stock of lending (or borrowing) which turns over regularly with the market to “engineer”, so far as is possible, an *ex ante* imbalance. In principle, the manner in which reserves are added or withdrawn is not relevant. But, increasingly, if the liquidity of the market and the degree of counterparty competition permits, central banks prefer to use sale and repurchase (“repo”) transactions in Open Market Operations.

In terms of market balance, “surplus liquidity” can be thought of as a continuing situation of *ex ante* imbalance where there is a persistent tendency for increases in the supply of reserves to add to the market’s working balances. Hence, autonomous reserve inflows to the market routinely exceed autonomous reserves outflows. This outcome is usually based on large and persistent increases in one or two of the autonomous liquidity sources on the central bank balance sheet. Injections of reserves from these sources dominate withdrawals on an on-going basis to create a surplus. Historically, the most important autonomous factors in the creation of surplus reserves have been increases in net foreign assets and in net lending to government (as discussed in section 3).

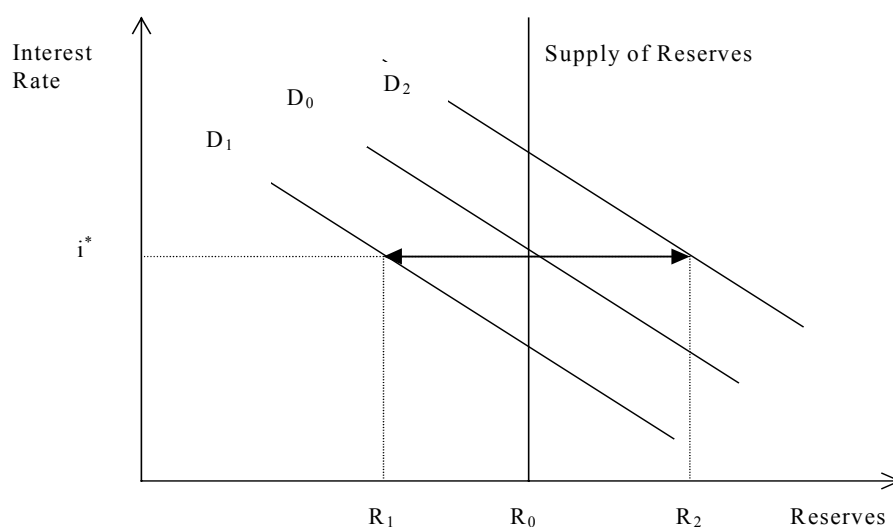
6.2. Monetary Policy Implementation

In this context, the central bank will usually choose to intervene in the market for reserves to influence the overall impact of autonomous liquidity flows with two objectives:

- To implement monetary policy
- To manage liquidity conditions in the market

What precisely these objectives require will vary from country to country, reflecting policy choices regarding the central bank's operating instrument and the level of financial market development. Where the banking system is just beginning to develop, and inter-bank trading is light, the central bank is apt to rely more heavily on reserve requirements and Standing Facilities. In more developed markets, central banks will usually prefer indirect, market-based methods of monetary control like repo.²⁵

Figure 1. The Market for Central Bank Reserves



Since the central bank is the monopoly supplier of domestic currency, the classic operational choice – at least for central banks in more developed markets – will be to set either the quantity or the price of reserves.²⁶ A crucial difference between the two is that, in the case of price targeting, changes in the central bank balance sheet become endogenous, while they are exogenous in the case of quantity targeting. Gray, Hoggarth and Place (2000) argue that most central banks consider volatility in short-run interest rates is potentially harmful to the economy, and so, in nearly all cases they choose to smooth the price and supply reserves to the banks on demand.²⁷ In terms of Figure 1, the central bank will supply any quantity of reserves, say R_1 or R_2 , to accommodate shocks to demand. In so doing, the central bank maintains the price of reserves at its desired rate, i^* , while the quantity of reserves becomes

²⁵ A survey of actual central bank operating procedures in emerging markets is covered in Van't dack (1999); practice in industrial countries is covered in Borio (1997).

²⁶ Poole (1970) is the seminal contribution on the central bank's optimal choice of a price or quantity instrument.

²⁷ Probably the best known exception was, until 1999, the Swiss National Bank, which sought to fix the size of the monetary base. Under quantity targeting, the central bank does not accommodate shocks to demand and tolerates the resulting (endogenous) interest-rate fluctuations. As noted, in this case, changes in the quantity of reserves on the central bank balance sheet are exogenous.

endogenous reflecting movements in the autonomous sources of liquidity over which the central bank has no control.

In the very short run, therefore, most central banks will supply whatever quantity of reserves the banks require to meet daily, weekly and monthly seasonal fluctuations. But over longer periods of say one year, the central bank may seek to keep the level of reserves broadly in line with relationships linking the demand for reserves to wider policy goals. Historically, it has been possible in some countries to identify stable linkages between reserves demand, the monetary aggregates and nominal GDP. Although these statistical relationships may break down over time – because of factors such as financial innovation – they can in principle be used as a guide to keep the level of reserves consistent with monetary policy targets over the longer run.

Using the terminology of section 5, the “Supply of Reserves” in Figure 1 can be interpreted as the central bank’s policy position: its gross addition or withdrawal of reserves from the market. The demand curves (D_0 , D_1 , D_2) represent the banks’ marginal demand for working balances. Figure 1 is couched in terms of a reserves shortage where the central bank is adding (lending) positive quantities of reserves (R_0 , R_1 , R_3) to the market: the central bank is a net creditor with the banks. By contrast, if the banks hold surplus reserves, the central bank’s policy position will be “negative”, in that it is withdrawing reserves from the market and has the status of a net borrower (at least in flow terms).

In principle, central banks can operate to set policy with either *ex ante* shortages or surpluses. But Borio (2001) argues that many central banks prefer to operate with reserves shortages; that is, as net creditors, not net debtors, with the market. In the shortage situation, autonomous sources of reserves will be exhausted such that the central bank – as the ultimate creator of reserves – finds itself in a monopoly position as a lender to the market. Because the central bank is the monopoly supplier of reserves it is able to engage in credit transactions with the market as a *price setter*, thereby setting the marginal price of the banks’ liabilities. If the shortage is a continuing feature of the market, the central bank becomes a net creditor of the banking system in both stock and flow terms.

Where cash flows into the market exceed flows onto the central bank balance sheet, the banking system experiences a surplus and the central bank intervenes to withdraw reserves. It will do so in the first instance by running down its assets, for example by allowing the market to repay any existing borrowings. Subsequently, it may sell foreign currency or financial assets such as central bank bills. These transactions operate on the asset, rather than the liability side, of the commercial banks’ balance sheets. That is, the central bank attempts to set the yield on the banks’ assets, rather than the cost of their liabilities.

The key difference here compared to the reserves shortage situation is that the *central bank is not a monopoly supplier of financial assets per se*.²⁸ Moreover, if there is surplus liquidity in the banking system, then commercial banks can feel more confident about their ability to settle future payments transactions. As a result, the banks have an option, but not an obligation, to participate in reserves absorption operations. They cannot be forced to participate and, if they choose not to, the link between the central bank’s intervention rate and

²⁸ Although there will be a range of alternative assets to buy other than central bank bills, the central bank could still have the status of a monopoly borrower (buyer) of reserves.

market rates may be broken or weakened. Even if the central bank raises the yields it will accept in bill sales, the banks may take a longer view than simply trying to earn the highest rate of interest over the next 28 days. They might prefer to lend their surplus cash to commercial borrowers from whom they hope to get other kinds of new business, even if the central bank offers higher rates of interest in the short term.

Thus, participation in central bank absorption operations depends on the banks' asset demand preferences. As suggested above, it may be that the private sector has many attractive borrowers with good credit ratings. However, the banks may believe that there is very high credit risk in the private sector, reflecting either current business conditions or, in some countries, overhang of bad debts from the Communist era. In the latter situation they may be very wary of private sector lending and prefer to buy assets guaranteed by the official sector. If the central bank is seen as the *monopoly supplier of risk-free assets*, it may be easier to get the banks to participate in liquidity withdrawal operations. Conceivably, these purchases would still need to be reasonably large relative to their balance sheets. Relatively small purchases might still limit pass-through to rates further out along the yield curve.

Data presented in Borio (1997) show that the sign and size of the structural position vary both from country to country and over time in the same country. In Table 6, sources and uses of reserves are defined as average monthly flows, expressed as a percentage of the stock of currency in circulation plus reserves (this is a proxy for the size of the central bank's balance sheet). For example, the net autonomous balance in the Netherlands switched from a surplus of 1.9% in 1992-93 to a shortage of 1.1% in 1994-95. It is clear, however, that there are substantial swings for the central bank to offset in the size of the imbalance: the standard deviation of the autonomous sources in the Netherlands was almost 10%, in France 30.4% and in Sweden as high as 46.4%.

Table 6: Market balance and central bank intervention

	Ex ante balance		Net policy position of central bank		Bank reserves ¹		Memo: Standard deviation ²	
	1992 – 93	1994 – 95	1992 – 93	1994 – 95	1992 – 93	1994 – 95	Ex ante balance	Net policy position
Australia	-1.33	-2.22	1.44	2.35	-0.10	-0.13	8.1	8.0
Austria	0.44	0.28	-0.43	-0.35	-0.01	0.07	2.9	3.1
Belgium	-0.62	0.14	0.62	-0.14	0.00	0.00	3.7	3.7
Canada	0.79	-1.46	0.06	1.42	-0.85	0.04	4.7	3.4
France	-4.11	4.06	3.30	-4.04	0.81	-0.02	30.4	31.0
Germany	-0.01	-0.45	-0.15	-0.29	0.16	0.73	4.3	4.4
Italy	-1.53	-0.73	1.04	0.03	0.49	0.71	6.1	6.4
Japan	0.59	-1.12	-0.71	1.17	0.11	-0.05	7.3	7.5
Netherlands	1.87	-1.06	-0.09	-1.20	-1.78	2.26	9.7	2.3
Spain	-3.65	-0.12	3.17	0.15	0.49	-0.03	13.2	13.7
Sweden ³	8.00	3.07	-7.86	-3.38	-0.14	0.31	46.4	46.2
Switzerland	-0.56	0.57	0.57	-0.57	-0.01	0.00	4.4	4.6
United Kingdom	-2.74	4.07	2.77	-4.08	-0.03	0.01	14.6	14.6
United States	-0.72	-0.55	0.75	0.46	-0.03	0.09	0.8	1.0

Average monthly changes as a percentage of the average level of currency and bank reserves	
Australia	0.5
Austria	0.8
Belgium	0.0
Canada	1.9
France	2.7
Germany	2.6
Italy	2.8
Japan	0.9
Netherlands	9.7
Spain	3.7
Sweden ³	1.1
Switzerland	0.4
United Kingdom	0.7
United States	0.4

Notes: “+” indicates liquidity injection and “-” liquidity withdrawal. ¹ Working balances/excess reserves are not shown separately because they are generally negligible. ² For the period 1992-95. ³ Owing to changes in operating procedures, especially in 1994, the series are not homogeneous. *Source:* Borio (1997).

7. Sterilisation of Surplus Liquidity

There are several ways central banks can drain surplus reserves from the market. Section 7 offers a summary of these, based on experience in recent years. For precise, up-to-date details of operations it is advisable to refer to central bank monthly bulletins and annual reports.²⁹ Most techniques can be classified as either market or non-market approaches. Market-based approaches involve any financial transaction between the central bank and the market which leads to a withdrawal of liquidity. Ideally, these absorption transactions create a regular shortage in the market; but in practice this is rarely achieved. The non-market approach involves quantitative barriers, rules or restrictions on market activity which try to keep potential injections of liquidity outside of the banking system. And, of course, central banks may resort to increases in reserve requirements. It is worth observing that none of these approaches is likely in themselves to remove the underlying causes of surplus reserves. Large foreign currency inflows, fiscal monetisation, weaknesses in market forces and financial infrastructure are usually beyond the direct influence of the central bank. In this sense, the central bank may have remedies to deal with the symptoms of surplus reserves, but not with their underlying causes.

7.1. Market-based Remedies

A whole range of transactions with the banking system may be used to remove liquidity. The following suggest themselves:

- Conventional outright and repo transactions in Treasury bills or government bonds;
- Standing (deposit) Facilities;
- Sales of central bank assets and liabilities, including central bank bills, bonds, and deposits.

There are many possible variations on these, and practice tends to vary from one country to another. Typically, outright transactions and repo may well remain the centrepiece of operations, in being the central bank's preferred tool for signalling the desired stance of policy. And, as often as not, these operations will be supplemented with some form of Standing Facilities. These may be standard deposit facilities priced at a penal rate, currency swaps or repo of foreign currency securities. These transactions are, in their "pure" form, initiated at the discretion of the banks themselves, although the central bank can, if it chooses, activate the use of Standing Facilities. For example, the central bank may try to incentivise use of the deposit facility by making the deposit rate less penal relative to market rates; it may also lengthen the term of deposits to lock up reserves for longer.

7.2. Auctions of Assets and Liabilities

Most central banks have, however, have found it useful to engage in supplementary operations to withdraw liquidity. In the most common approach, the central bank engages in sales of assets (e.g. government bonds) or in the creation and sale of its own liabilities. This usually means the central bank sells its own short-term bills, often with a maturity of two to

²⁹ A good place to find links to national central bank web sites is www.bis.org/cbanks.htm.

four weeks, but sometimes of up to six months.³⁰ In some cases it will auction deposits, CDs or longer maturity bonds with a maturity of a year or more (as in Hungary and Poland). Sales are usually conducted through competitive auctions. In this way, banks bid for central bank liabilities, and reserves flow into the central bank in payment.

A number of countries – Cyprus, Hungary, Mexico and Uganda for example – have introduced competitive auctions for the acceptance of deposits from the commercial banks. These can work in various ways. In Cyprus the central bank holds either an interest-rate tender or a volume tender. In the former, it announces the maximum interest rate it will accept and the total quantity available. In the case of volume tenders, it announces a fixed interest rate with the volume of deposits unspecified before the auction.

The resulting reduction in the banks' working balances is referred to as the "sterilisation" of excess reserves. Historically, foreign exchange intervention in defence of an exchange-rate commitment has probably been the most common context in which central banks have attempted to sterilise increases in liquidity. Where there is upward pressure on the parity, the central bank intervenes, selling domestic currency and acquiring foreign assets. Sterilisation is an attempt to offset the impact of the intervention transaction on the monetary base, in this case by contemporaneous sales of domestic financial assets from the central bank balance sheet. As Obstfeld (1982) explained, the offset transaction can be viewed "as an attempt to attain independent exchange rate and money-stock targets in the short run".

7.3. Costs and Benefits of Liquidity Sterilisation

One way of evaluating the success of sterilisation is to consider what costs these operations may impose. How far policy works will reflect a range of factors. For example, in partially-dollarised economies, the amount of outstanding debt in domestic currency may be very low, which will in any case marginalise local monetary policy. Likewise, countries which experience high rates of FDI, and hence increasing foreign ownership, may find that there is an increasing tendency for the corporate sector to finance itself abroad.

There are important considerations for the central bank when undertaking sales of its own liabilities. There may be new documentation requirements and, in order to make the sale attractive to the banks, it may be necessary to offer yields above the central bank's desired intervention rate. This is because the central bank is not a monopoly supplier of assets to the banks and so they are free to choose not to participate in bill auctions.

In terms of technique, the central bank may prefer to use a multiple price – rather than a single price – auction format when the market is in surplus. This allows it to give some, but not all, bidders the opportunity to realise a higher yield.³¹ In the multiple-price situation, the central bank is able to discriminate between successful bidders allowing them to pay the price they bid and therefore to receive different yields. However, the variety of yields that are paid in the multiple-price auction creates ambiguity over the central bank's desired intervention rate. For this reason, the central bank may state that its liquidity-draining auctions do not

³⁰ A long line of central banks have, at one time or another, adopted this approach; they include the central banks in Botswana, Croatia, Ghana, Mauritius, Mozambique, Slovak Republic, Uganda and Yugoslavia.

³¹ This is analogous to the situation in the United Kingdom. When the market is short of reserves these are allocated at a fixed price; in the more unusual situation when there is a surplus, bids are taken on a multiple-price basis. See Bank of England (2000b).

signal the stance of monetary policy. In Hungary, for example, the National Bank explicitly adopts a rate-taking stance at its bill auctions, preferring to signal policy at a fixed rate through its two-week central bank deposit facility.³² The central bank also faces the dilemma that should it allow yields to rise at bill auctions, this may put further upward pressure on the exchange rate leading to new injections of liquidity. Difficulties encountered selling central bank bills to the banks encourage auctions of longer maturity instruments to avoid the increased refinancing risk of more frequent sales. Hence Hungary and Poland have issued central bank bonds with maturities of one year or more. The benefits of doing this will have to be traded off against the likelihood of higher servicing costs for longer maturities.

If central bank intervention is sustained over long periods, it raises issues over the composition of its balance sheet. If it intervenes continuously, net foreign assets may become a growing proportion of the balance sheet. This has the potential to lead to large currency mismatches between its assets and liabilities. Allowing the exchange rate to float will limit the development of these mismatches since this removes the need for intervention and stops, *ceteris paribus*, further additions to the central bank's foreign currency holdings. Of course, the outstanding *stock* of net foreign assets would, other things equal, remain on the balance sheet. If a fully-free float is not deemed possible, it may help to move to a crawling peg or a system of exchange rate fluctuation bands, gradually increasing these in width to lessen the need for intervention. Also, sterilisation often has fiscal implications because the servicing cost of the domestic currency liabilities exceeds the yield on the extra reserves.

Asset sales may have important implications for the income and profitability of the central bank. In the reserves shortage situation, the central bank is a net creditor of the banks and *receives* interest on reserves lent to the market. As a net debtor in the surplus case, the central bank *pays* interest, possibly at a premium to get the banks to participate. If the yield it pays the banks is greater than the yield on the corresponding assets carried on its balance sheet, the central bank makes losses on these transactions. This will be reflected in a lower dividend payable to the finance ministry or in an outright loss. The possibility of sustained losses at the central bank could threaten its wider reputation and credibility in the markets and therefore its ability to steer monetary policy. If the central bank made outright losses over a period of time, it might have to be recapitalised by the government and this could undermine its independence. As Stella (1997) argues: "...seriously deteriorated balance sheets causing chronic losses will eventually interfere with price stability[;]...the appropriate level of central bank net worth is that sufficient to ensure that in the normal course of operations, the bank will preserve its financial independence from the treasury".

In addition to a lower dividend, the finance ministry may suffer other implications of absorption transactions. For example, if yields in the markets have risen, so too will the government's debt-servicing costs. There may be a more direct conflict of interest if the central bank is offering financial instruments similar to those with which the government is attempting to fund its deficit. In this case the central bank will need to distinguish central bank bills in terms of maturity and possibly to work to an issue calendar which avoids direct competition with the timing of sales of Treasury Bills for the government. This will require careful coordination between the central bank and the finance ministry.

³² See Chapter IV, *Annual Report 2001*, National Bank of Hungary.

It is a longstanding principle at many central banks that they do not compete directly with the banks in the provision of services to the public. However, in a situation of continuing surplus reserves, this has been contemplated in some cases. The National Bank of Poland for example introduced deposit facilities for the general public in the 1990s (Szpunar (1998)). This is a relatively unusual measure and was designed to have two effects. In the first case, they will reduce the amount of liquidity in the banking system. Equally important, the entrance of the central bank into the market adds a new element of competition for funds which should reduce the stickiness of commercial bank rates in relation to changes in the central bank intervention rate. This indirect effect on pass-through may be more significant where the banking industry is highly concentrated – for example where the banks are in transition from state to market control. Depending on the expected duration of surplus liquidity, the central bank may decide to offer longer-term deposit accounts (say for 2 years or more) in order to keep reserves out of the system for longer.

Turning now to sterilisation benefits for a moment. Clearly, the most important benefit that sterilisation can have is in achieving its prime goal of removing surplus liquidity from the market effectively, so that monetary policy is not compromised. But in addition to absorbing liquidity, central bank asset sales may contribute to financial market development. Central bank securities will be equivalent to government securities in terms of credit risk. This increases the volume of top-quality collateral available to banks for their short-term borrowing, and so it may assist in the development of an active inter-bank market.

7.4. Non-market remedies

Central banks may also consider non-market remedies like quantitative controls on the foreign exchange market. These can take various forms. They are designed to stop foreign currency inflows entering the country and being converted into domestic reserves. For example, the central bank may allow foreign currency sales only through its own balance sheet with no open market permitted. Or it may restrict transactions to purposes deemed to be for current trade or inward direct investment only. Transactions for speculative purposes could be forbidden – though this may be hard to enforce. Similarly, the central bank may require that incoming deposits of “excess” foreign currency be placed directly on its balance sheet, to prevent their being converted into domestic reserves.³³

Likewise, the central bank may raise reserve requirements. Unlike a system of regular asset sales, Blenck (1996) argues that this has the advantage that little market infrastructure is required to implement the increase; all it requires is a reliable statistical method for tracking banks’ reservable liabilities. But there would be many disadvantages, particularly for European Union accession countries where the size of the increase required would be unrealistic – as they have a long-run goal of converging on the European Central Bank’s 2% rate.³⁴ Of course, reserve requirements also tax the banks’ profitability and are a very blunt instrument from the point of view of daily liquidity management. The underlying issue with quantitative measures more generally is that they may delay or reverse the transition from direct to indirect forms of monetary control.

³³ Sinclair and Shu (2001) provide a summary of the options in implementing and maintaining capital controls.

³⁴ The euro zone has a substantial structural liquidity deficit and will in all probability absorb the “local” national surpluses experienced in some accession countries when they join the monetary union.

Schaechter (2001) suggests a (one-off) mechanism similar to increases in reserve requirements. Quite simply, if the government banks in the private sector it can withdraw some or all of its deposits from the commercial banks and place them instead on accounts at the central bank. The amount of liquidity involved is potentially large. This occurred in Lithuania in the second half of 2001.

Finally, Serdengeçti (2002) argues that non-central bank institutions have a role to play. In particular, the government can assist during times of large capital inflows by running a fiscal surplus to offset the liquidity entering the country from abroad. Clearly, the level of fiscal responsibility is a key influence on monetary policy. Similarly, cooperation will be needed between several agencies (government, regulator, central bank) to encourage the development of capital markets. Well-functioning and liquid bond and equity markets will provide a “home” for surplus reserves outside of the banking system.

8. Summary

Surplus reserves arise where inflows of liquidity to the market persistently exceed outflows to the central bank balance sheet. This means that the banks’ working balances will exceed their required reserves on an on-going basis. As a result, the banks may be unwilling to participate in operations for the implementation of monetary policy. This may force the central bank to adopt different intervention procedures with potentially difficult implications for its income and finances. Historically, the main factors driving this have been central bank monetisation of fiscal deficits and inflows through the capital account. In recent years, this has been observed in banking systems in many parts of the world, so its applicability is potentially very wide and it may have important implications for both central bank policy and operations. In this context, the purpose of this paper has been to examine carefully the ways in which surplus liquidity arises, how far in practice this represents a problem for central banks and, if so, what the possible responses might be.

We have seen that, in many countries, there is a lack of good data on interest rates, either because market trading is thin or because market forces do not operate. This creates an important role for measured liquidity, in so far as it may be the only firm financial data available. But in what sense does this liquidity matter? From the central bank’s point of view, the optimal level of liquidity might be that level of reserves consistent with the monetary authorities’ policy targets – whether these are for the monetary aggregates, the exchange rate or inflation. This turns on how far reserves are *willingly* held in full as the outcome of well-informed choices by households, firms and banks. For example, surplus liquidity may be willingly held for “signalling purposes”, where a bank chooses to hold excess reserves as an indicator of liquidity strength to its customers and owners (shareholders).

Of course, at least some part of cash balances may not be desired, reflecting surges in liquidity imposed through heavy government borrowing, or large capital inflows. This may have implications for all the main channels of monetary transmission, with surplus reserves feeding directly into increases in narrow money growth, aggregate demand, asset prices and

inflation. The central bank may find it more difficult to control a pick up in inflation since its ability to transmit its target rate to the market is constrained when it is borrowing (rather than lending) reserves. The central bank is not able to force the banks to lend to it and so, potentially, the interest rate channel of monetary transmission is weakened. Hence, there are two important implications of surplus liquidity at the “macro” level. First, surplus liquidity may provide an unwanted stimulus to the economy and, second, the central bank’s ability to control this may be constrained relative to a reserves shortage situation.

Surplus liquidity may also have implications for the exchange rate – particularly in the event of a currency crisis. Excess balances may find their way into the foreign exchange markets if the public prefers to hold some of its liquidity in foreign currency. This will put (further) downward pressure on the domestic currency and could have knock-on effects on inflation. At the same time, in a situation of persistent surplus reserves, the central bank will be a net debtor with the market and is likely to have problems refinancing its short-run borrowing (which probably has a maturity of a few weeks). Its counterparties are unlikely to participate in these operations unless the central bank raises interest rates, both to make its refinancing attractive and to prevent an even steeper depreciation of the currency.

So there is a danger that a central bank’s liquidity absorption operations will be a relatively weak tool for the transmission of its desired interest rate into the economy. Over long periods these operations will have important implications for the central bank’s finances. Sales of liabilities like central bank bills to absorb reserves will come at a servicing cost which is not offset elsewhere on its balance sheet. This may seriously affect the central bank’s income and its independence from government: If the central bank persistently made losses it could require recapitalisation by the government.

In practice, how big these problems become for the central bank is an empirical question which requires country-by-country analysis. In some countries with persistent reserves *shortages* there are question marks over interest rate pass-through and the success of monetary policy implementation. Likewise, countries such as the Czech Republic, Finland (pre-euro entry) and Hungary have experienced surplus reserves *without* any significant issues for policy. So, in itself, systematic market imbalance reflecting surplus reserves may not be the issue – or only part of it. Central banks will wish to balance their operational and policy difficulties against the possible wider benefits of foreign currency inflows, especially in transitional economies. Sizeable increases in inward investment may complicate liquidity management, while at the same time boosting the supply-side potential of the economy. This may bring long-run price stability benefits.

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