

# Intervention: what are the domestic consequences?

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## Introduction

The conventional wisdom is that central banks can intervene in foreign exchange markets to resist currency appreciation for some time because there is no simple, clear ceiling to the volume of domestic currency they can sell in forex markets. Equally conventional is the view that prolonged, large-scale intervention must eventually weaken domestic macroeconomic performance - whether because of higher inflation, the costs of misaligned exchange rates or distortions in the financial system or the exchange rate/maturity exposures built up by the public sector. Yet massive intervention during the five years 2000 to 2004 by the major emerging market central banks - especially Asian central banks - has not apparently had such negative effects. Indeed, inflation has been low, financial systems appear stronger and there has been sustained growth. What has happened? This paper seeks to answer this question.

The main reason for policy dilemma is that intervention in the foreign exchange market has direct implications for the stance of monetary policy. In some circumstances, the central bank may want *both* to resist currency appreciation *and* to ease monetary policy. If so, intervention would create no conflict with monetary policies. If not, the central bank would have to ensure that money market rates are held constant in the face of intervention; some would express this alternatively in terms of holding the monetary base broadly unchanged. This is the process of sterilisation.<sup>2</sup>

When intervention in the foreign exchange market (and the corresponding operations in money markets) are small, or where net positions tend to reverse quickly, preserving the stance of monetary policy through sterilisation operations will be comparatively easy. But as interventions become larger, or go on for longer in one direction, the conflict between monetary and exchange rate objectives becomes progressively harder to resolve. Financial markets come more and more to suspect that official targets for interest rates and for exchange rates are inconsistent - and that, sooner or later, one of these objectives must give. Difficulties are: (a) distortions may be created in the financial sector; and (b) heavy financing costs may be incurred by the authorities.

The rest of the paper is organised as follows. Section 1 discusses the recent experience of intervention, highlighting in particular the main differences between the current episode and two earlier periods of heavy intervention by emerging market central banks (1990-93 and 1995-96). Section 2 explores the implications for monetary policy. Section 3 examines the consequences and costs of prolonged intervention. While Section 4 deals with the choice of instruments, Section 5 concludes.

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<sup>2</sup> The Jurgensen report (1983) provides a formal definition: "sterilized intervention (on the basis of a broader definition) means a change in the monetary authorities' net foreign currency assets which is offset by a corresponding change in their net domestic assets, so that their monetary liabilities (or, specifically, the monetary base) remain unchanged. If, on the other hand, the change in the authorities' net foreign assets is accompanied by a corresponding change in their monetary liabilities (so that, for instance, a reduction in foreign currency reserves would result in a reduction in the monetary base), the intervention is said to be unsterilized". The operation generally involves a two-step process. In the first step, the monetary authority buys foreign currency assets by crediting cash to commercial banks' accounts. This increases bank reserves beyond the normal settlement cash and compulsory reserve requirement, if any, that banks are required to keep with the central bank, temporarily raising the monetary base. In the second stage, the central bank sells domestic assets (assumed to be government bonds) from its portfolio through an open market operation, and banks use their excess deposit to settle securities purchases from the central bank. This restores bank reserves and monetary base to the original equilibrium, preventing an unwarranted easing of monetary policy. This is sterilised intervention, the net effect of which is a change in the composition of domestic and foreign currency assets with the public.

## 1. Recent experience

### Nature of foreign inflows

The accumulation of reserves for emerging markets as a whole over the period 2000-04 has generally reflected current account surpluses, rather than heavy capital inflows. This is the opposite of the pattern seen in the 1990s - when the aggregate current account balance for the emerging world as a whole was negative and capital inflows large. Table 1 provides the aggregate regional magnitudes, while the country detail is given in Table A1 in the Annex. Most of the smaller East Asian economies actually had net capital outflows during 2000-04. Major oil-exporting countries (Algeria, Venezuela and Russia) have generated large surpluses. Nevertheless, capital inflows have been large in China,<sup>3</sup> India and Korea. Although net capital inflows to Latin America as a whole remains far below the level seen during the early 1990s episodes, they have played a substantial role in Brazil and Mexico during the past four years. In central Europe, heavy capital inflows exceeded current account deficits.

Faced with these inflows, one response of countries may be to intervene to prevent the exchange rate from appreciating. Such a choice depends in part on the nature of the shock. For instance, a temporary inflow might require intervention whilst a more permanent change might demand currency appreciation. The response might also be different depending on whether pressure on the exchange rate is coming from the current account (which might respond in a stable and predictable way to currency appreciation) or from the capital account (perhaps less easily amenable to the exchange rate?). There are of course many other dimensions of possible shocks.

How far the recent inflows are more *permanent* than the inflows seen in the early 1990s is difficult to judge. Current account positions tend to be less volatile than capital balances, although the present surpluses of some oil-exporting countries are temporary. Capital inflows in the 1990s were often driven by high nominal interest rates on local debt securities - and were therefore inherently volatile. More recent inflows (eg FDI) have perhaps been more permanent - or at least more stable.

Table 1  
Capital flows, current accounts and intervention<sup>1</sup>

|                                    | Net capital flows |            |                        | Current account balance |             |                        | Change in reserves |           |                        |
|------------------------------------|-------------------|------------|------------------------|-------------------------|-------------|------------------------|--------------------|-----------|------------------------|
|                                    | 1990-1993         | 1995-1996  | 2000-2004 <sup>6</sup> | 1990-1993               | 1995-1996   | 2000-2004 <sup>6</sup> | 1990-1993          | 1995-1996 | 2000-2004 <sup>6</sup> |
| Asia, large <sup>2</sup>           | 46                | 119        | 350                    | 28                      | -18         | 354                    | 18                 | 47        | 649                    |
| Asia, other <sup>3</sup>           | 81                | 70         | -206                   | -32                     | -40         | 285                    | 75                 | 16        | 88                     |
| Latin America <sup>4</sup>         | 128               | 100        | 77                     | -86                     | -64         | -67                    | 57                 | -10       | 44                     |
| Central Europe <sup>5</sup>        | -3                | 23         | 85                     | -6                      | -13         | -74                    | 9                  | 11        | 24                     |
| <b>Developing countries, total</b> | <b>326</b>        | <b>332</b> | <b>238</b>             | <b>-170</b>             | <b>-165</b> | <b>513</b>             | <b>164</b>         | <b>59</b> | <b>922</b>             |

<sup>1</sup> In billions of US dollars. <sup>2</sup> Sum for China, India, Korea and Taiwan (China). <sup>3</sup> Sum for Hong Kong SAR, Indonesia, Malaysia, the Philippines, Singapore and Thailand. <sup>4</sup> Sum for Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. <sup>5</sup> Sum for the Czech Republic, Hungary and Poland. <sup>6</sup> Up to September 2004.

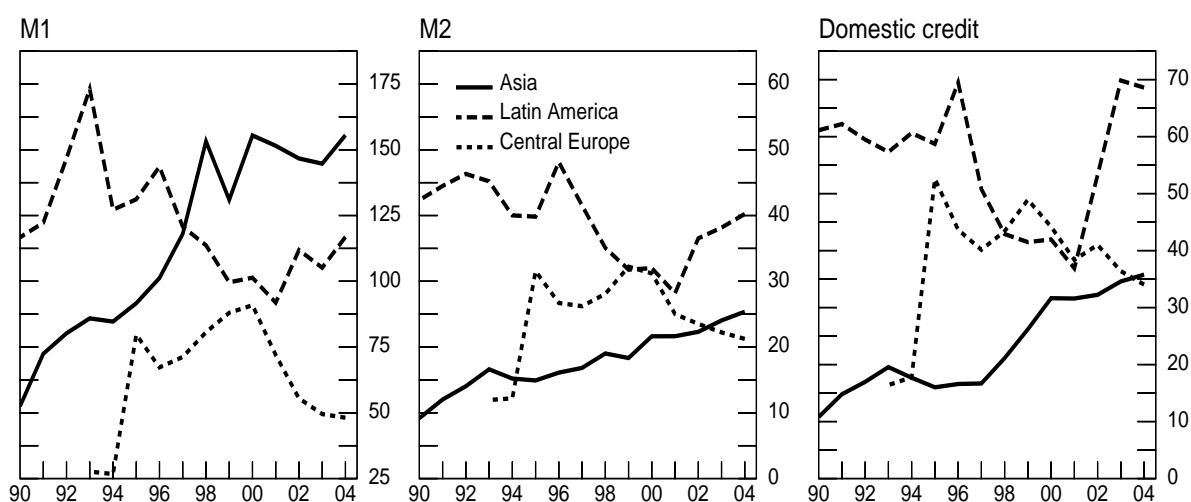
Sources: IMF, *Balance of Payments Statistics*.

<sup>3</sup> Ma and McCauley (2004) provide several reasons for the recent increase in non-FDI inflows into China. A steady fall in the differential between the onshore dollar deposit rate and the renminbi deposit rate to negative levels since 2001 has led Chinese residents to reduce their long dollar positions in favour of renminbi deposits and firms to increase their foreign currency borrowing. Such a trend may have been further reinforced by the expectation of a future revaluation of the fixed exchange rate, increasing the profitability of long renminbi/short dollar positions. One indicator of the rise in short-term inflows into China has been the reversal of errors and omissions in the balance of payments from annual average outflows of about \$14 billion since 1995 to 2001 to inflows of over \$13 billion in 2002 and 2003; see Xie (2004).

## Scale of intervention

In the 1990s, the foreign exchange reserves of developing countries as a group were a small percentage of the volume of cash in the hands of the public. The monetary authorities in many countries therefore did not have to issue interest-yielding securities on a large scale to finance reserve accumulation. The financial implications of intervention were consequently limited. One simple indication of this is the movement in the difference between the local currency value of foreign reserves and currency held by the public, which rose from less than \$30 billion in Asia at the end of 1990 to over \$780 billion at the end of 2004 and from \$44 billion to \$139 billion in Latin America. In particular, the gap increased sharply in China from –\$38 billion to \$227 billion during this period and in Korea from \$5 billion to \$169 billion.

Graph 1  
**Foreign reserves minus  
 currency held by the public**  
 As a percentage of



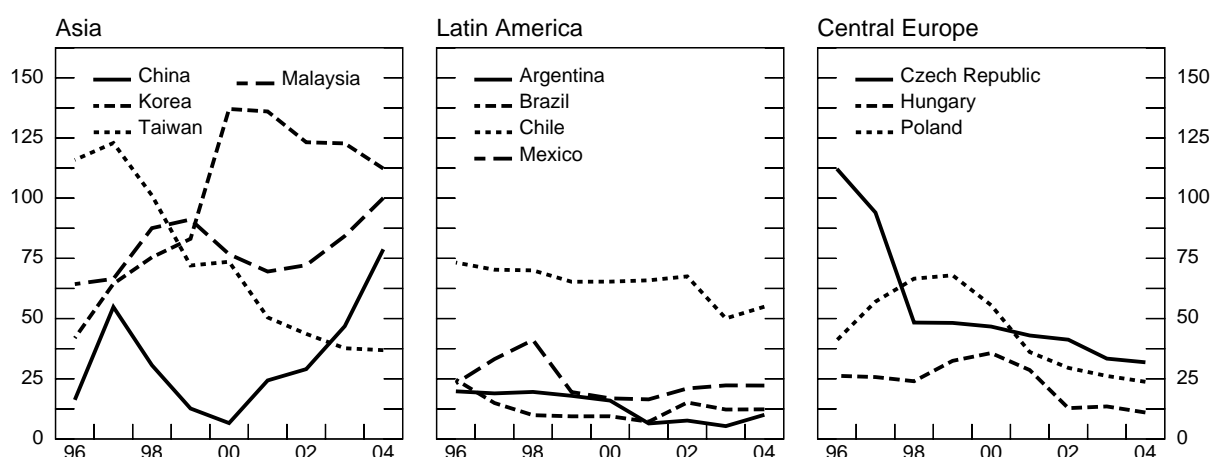
Sources: IMF; national data.

The movement in this gap is also large in relation to some simple measures of the size of the financial system - such as M1, M2 or domestic credit as shown in Graph 1. For instance, this gap (foreign reserves minus currency with the public) to broad money reached over 25% of M2 in Asia at the end of June 2004 compared with 9% at the beginning of the 1990s. In some Asian countries such financing gaps are much higher (see Annex A2). In Latin America, reserves were a high proportion of monetary aggregates in the first half of the 1990s. Since then, however, reserves have grown less rapidly in relation to currency with the public, with the financing gap declining since the mid-1990s until about 2002.

Another way to look at the scale of intervention is to compare the excess of foreign reserves over currency to the outstanding stock of public sector debt securities (Graph 2). The ratio has risen sharply in many Asian economies, exceeding, for instance, 70 to 100% in China, Korea and Malaysia. The central bank financing gap has thus accounted for a very large part of the available stock of risk-free securities in the economy. Such ratios have also risen in Brazil, Chile and Mexico during the past two years or so. In central Europe, however, the volume of debt issuance has been much higher than reserve accumulation.

Graph 2

**Foreign reserves in relation to outstanding debt securities<sup>1</sup>**



<sup>1</sup> Calculated as the ratio of foreign reserves net of currency in circulation over outstanding public sector debt securities.

Sources: IMF; national data; BIS statistics.

## 2. Coordination with monetary policy

A first challenge the monetary authority faces is to coordinate intervention with monetary policy. As discussed in the paper by Disyatat and Galati in this volume, sterilised intervention could be effective through the portfolio balance channel (by affecting the relative scarcity of imperfectly substitutable assets) or through the signalling channel (for instance, by influencing expectations of future exchange rate or other policies).<sup>4</sup> But the close coordination with monetary policy that sterilised intervention assumes may not be easy to achieve in practice. At least three major potential problems can be identified:

- (i) *Monetary policy and exchange rate objectives may be inconsistent.* The monetary authorities will find it harder to prevent appreciation pressure while at the same time raising the interest rate. Israel's experience during the mid-1990s demonstrated such a dilemma (Elkayam (2004)). The Bank of Israel's attempts to keep the exchange rate within a narrow band while raising the interest rate to fight domestic inflation pressures attracted more capital inflows, pushing the exchange rate further towards the stronger side of the band. The central bank finally gave up its resistance to appreciation in favour of the inflation objective by considerably widening the stronger side of the exchange rate band in 1997.
- (ii) *"Distraction risk".* Truman (2003) argues that the authorities might be tempted to postpone fundamental adjustments hoping that intervention will succeed. He shows that during the late 1970s intervention against a weak dollar was primarily used as a substitute for monetary tightening in the United States. But the delay in tightening monetary policy eventually led to a sharp rise in inflation and the need to raise interest rates to a very high level. The tighter monetary policy, in turn, led to one of the worst recessions in US postwar history.

<sup>4</sup> In the limit, when uncovered interest rate parity (UIP) holds, sterilised intervention ceases to be an additional policy instrument: a lower exchange rate in the spot market means that the domestic interest rate must fall given investors' expectations about future appreciation.

- (iii) *Sending the wrong signal about monetary policy.* Intervention to resist appreciation might confuse the market when the central bank is raising interest rates to fight inflationary pressure. There is a danger that exchange rate policy might dominate monetary policy.<sup>5</sup>

In view of these challenges, what can be done to achieve better coordination?

One suggestion has been that intervention should be restricted to cases where it is consistent with the central bank's inflation forecast. For instance, intervention to resist depreciation should be accompanied by the forecast that inflation would - if depreciation occurred - rise above the target during the targeting horizon. Conversely, the central bank would intervene to resist appreciation only when inflation is forecast to fall below the target. Holub (2004) argues that in the Czech Republic such coordination has been maintained since the introduction of inflation targeting in 1998: most interventions against currency appreciation were carried out when (a) inflation was expected to fall below the target and (b) the output gap was negative.

Similarly, the Reserve Bank of New Zealand has recently proposed to intervene only against excessive *medium-term* swings in the exchange rate, when those swings cannot be explained by fundamentals. The criteria for interventions also require that they be consistent with the inflation objective. Interventions to limit exchange rate variations would, if necessary, be offset by greater interest rate variations to maintain monetary conditions appropriate for achieving the inflation target.<sup>6</sup>

Thus decision-making with respect to intervention is obliged to pay attention to the coordination issue, and in this monetary policy objectives are paramount. Archer (2004) provides a rationale for intervention under such criteria. In a small open economy, the exchange rate might play a dominant role in the monetary transmission mechanism from policy rates to output and inflation.<sup>7</sup> Intervention would seek to temper further appreciation pressures at the peak of the exchange rate cycle in order to stimulate activity in the tradable sector, while monetary policy would move into a tighter mode to restrict further expansion in the non-tradable sector. Similarly, moving towards the trough of the exchange rate cycle, intervention would restrict further expansion in the tradable sector but stimulate the domestic economy through a lower interest rate.

### Limits to sterilised intervention

A second question concerns the ability of monetary authorities to conduct sterilised intervention on a sustained basis. What are the limits to sterilised intervention? At least three major impediments have been discussed in the literature. This section outlines such impediments in general terms and subsequent sections consider their practical importance in the current situation:

1. *The impossible trinity - the central bank cannot indefinitely control both the nominal exchange rate and the money market rate.* This is the classic argument of Mundell (1968). In the case of intervention to prevent depreciation, such a limit will be often set by the reserves and contingency credit lines available to a country. Depleting reserves, at some stage, will make an interest rate increase inevitable. The limit on intervention to prevent appreciation is, however, less clear cut because reserves can keep rising. It could be argued, however, that resisting currency appreciation would prevent the domestic money market interest rate from falling, attract more inflows and thus continuously increase the need for sterilisation. Eventually, the cost of sterilisation would rise to high levels, leading either the interest rate to fall or the exchange rate to appreciate.<sup>8</sup> In the long run, therefore, appreciation becomes

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<sup>5</sup> See Truman (2003), who cites the remarks by Gerald Corrigan expressing concern about a conflict of objectives in the United States during the 1989-90 intervention episode when the government was trying to weaken the dollar while the Federal Reserve was tightening monetary policy.

<sup>6</sup> The Reserve Bank has also proposed another precondition, that intervention should be expected to have an effect on the exchange rate (see the paper by Eckhold and Hunt in this volume).

<sup>7</sup> In New Zealand's case a relatively high interest rate differential has been associated with strong capital inflows, rapid appreciation of the exchange rate and large declines in tradable good prices. Archer (2004) argues that in such circumstances a combination of intervention and policy rate adjustment would help to achieve a balanced income growth in the tradable and non-tradable sector, to the extent that interventions were successful.

<sup>8</sup> Mundell (1968) shows that sterilisation policy is inconsistent because it prevents the money supply and nominal income from rising to restore equilibrium in the goods and asset markets. The constraint, according to him, is that "if the central

unavoidable because even in the former case the resulting increase in money supply and inflation will lead to an appreciation of the *real* exchange rate.<sup>9</sup>

In the previous episodes, large-scale sterilised intervention had indeed led to sharp increases in short-term interest rates - particularly in countries with a history of inflation. Reinhart and Reinhart (1999) document evidences during the early 1990s.<sup>10</sup> In Chile the short-term interest rate (30- to 89-day bank lending rate) rose from about 28% in the period (1988-89) preceding capital inflows to over 46% during the period (January to July 1990) of heavy inflows and sterilisation. The rise in interest rates was as dramatic in Colombia, with prime lending rates of banks more than doubling from 22% during the pre-inflow period (1989-90) to over 47% during the peak of sterilisation (January to November 1991).<sup>11</sup> Such rate increases were also pronounced in Korea, Malaysia and Indonesia. Reinhart and Reinhart (1999) conclude that “sterilization policies were either abandoned or scaled back or complemented by capital controls, as it became evident that the high domestic interest rates were attracting more inflows”.

Note, however, that in low-inflation countries (where the running costs of holding reserves is low or even negative) that appreciation pressures can, at least from the perspective of this argument, be resisted for a considerable period of time.

2. *Imperfect substitutability among assets means that changes in the supplies of such assets as a result of sterilisation affects relative prices.* Classic models (eg Argy and Murray (1985) and Argy (1994)) typically assume that the central bank sells domestic bonds to sterilise. If domestic bonds (whose yield carries a risk premium) are imperfect substitutes of foreign bonds, the authorities would have to pay higher interest rates on their sterilisation bonds to encourage bondholders to switch out of foreign bonds.<sup>12</sup> Moreover, such impacts may be heightened in the face of several other imperfections in local markets.<sup>13</sup> Examples include: illiquid bond markets; lack of sufficient substitutability between domestic assets in investors' portfolio; and the concentration of capital inflows on only certain financial market segments (see Turner (1991), Frankel (1993) and World Bank (1997)). For instance, capital inflows may be concentrated in equity markets while central banks sell their own paper to sterilise such inflows. If asset holdings of the non-financial private sector were perfectly substitutable, it would be expected to sell equity and willingly buy additional claims on the central bank, increasing the assets demanded by foreigners. In the absence of such an adjustment, the interest rate on central bank securities may rise substantially to restore the portfolio equilibrium.

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bank sells securities at the same rate as it is buying reserves it cannot buy reserves at a rate fast enough to keep the exchange rate from appreciating. And if the central bank buys reserves at a rate fast enough to stabilise the exchange rate, it can not sell securities fast enough to keep the money supply constant” (p 255).

- <sup>9</sup> Frankel (1993) extends this model to study the impact under different types of shocks. The main argument is that sterilisation is difficult when the cause of the capital inflows is a rise in investors' confidence in the economy, raising their demand for monetary assets. Attempts to sterilise capital inflows to maintain a constant money supply in such cases would raise interest rates, leading to larger inflows. On the other hand, when the source of capital inflows is an external shock such as a decline in the foreign interest rate, sterilised intervention can be a viable option in the short run. While capital inflows will continue to respond to positive interest rate differentials, the problem will be contained by the fact that such a shock leaves the level of the domestic interest rate unaltered.
- <sup>10</sup> Nevertheless, such increases need also to be viewed in the context of the overall macroeconomy. To the extent that some countries witnessed overheating pressures, higher interest rates may have reflected the stance of monetary policy rather than sterilisation alone. Separating the two effects is difficult in the absence of proper econometric controls.
- <sup>11</sup> See Griffith-Jones et al (2001) and Reinhart and Dunaway (1996) for a description of several similar episodes of sterilised intervention during the early 1990s.
- <sup>12</sup> However, if nothing else changes, higher domestic bond rates might encourage a switch out of money and into bonds, leading to a subsequent fall in the interest rate.
- <sup>13</sup> In principle, the theoretical limit for sterilised intervention may be higher in emerging market economies than in the industrial economies. Such a finding is supported by empirical estimates of offset coefficients, which tend to be lower in the former than the latter group of countries; see, for example, Kouri and Porter (1974) and Fry (1993). With their greater integration with international financial markets in recent years the offset coefficients may have increased in a number of emerging market economies, reducing the scope of sterilisation. Moreover, the practical limits to sterilisation may be much lower in emerging market economies because investors may demand a large risk premium on their domestic assets, given the higher probability of default and illiquid markets for such debts.

A general point that several participants in the meeting stressed is that the demand for domestic assets is affected by the nature of the forex inflow that gives rise to the forex intervention. Where financial markets are thin (or the scale of intervention very large), differences between the assets supplied by the central bank in sterilisation and the assets demanded (eg by non-residents in the case of a capital inflow) can affect relative asset prices.

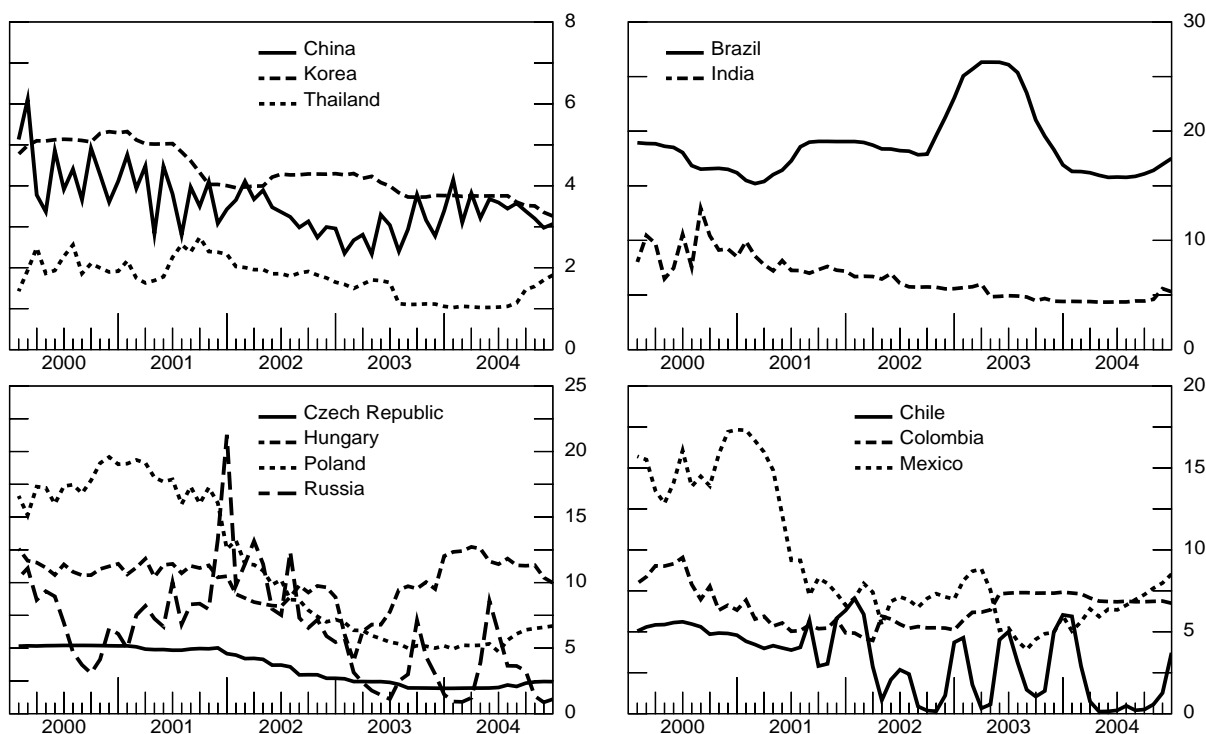
3. *The high costs of issuing high-yield local currency debt to acquire low-yielding reserves can exacerbate fiscal deficits and so threaten macroeconomic stability.* This can be particularly serious in countries that already have large public sector debts. In some circumstances, the combination of high costs and increasing reserves may provide a signal to markets that policy is on an unsustainable path and so accentuate destabilising capital flows.

Calvo (1991) argued that such effects would eventually weaken central banks' anti-inflation credibility by raising the spectre of debt monetisation and high inflation. Comparing the high interest rate differentials of Chile and Colombia with Argentina, which followed a policy of non-sterilised intervention during the early 1990s, Calvo et al (1993) cast serious doubts on the desirability of sterilised intervention because it raised debt service costs at a time when countries were attempting to bring domestic debt expansion under control. Similarly, Velasco and Cabezas (1999) attribute much of the origins of the 1994 Mexican crisis to the large stock of short-term Cetes and Tesobonos issued by the government for sterilising capital inflows. They argue that "the presence of a large stock of non-indexed debts kept alive in investors the fear that the Mexican government would eventually return to a high-inflation policy to reduce the value of outstanding liabilities".

The actual significance of these impediments can be minimised by a careful selection of instruments of sterilisation or switching to non-market instruments. Their use and implications are discussed in Section 4 of this paper.

Graph 3

**Short-term interest rates**



Source: National data.

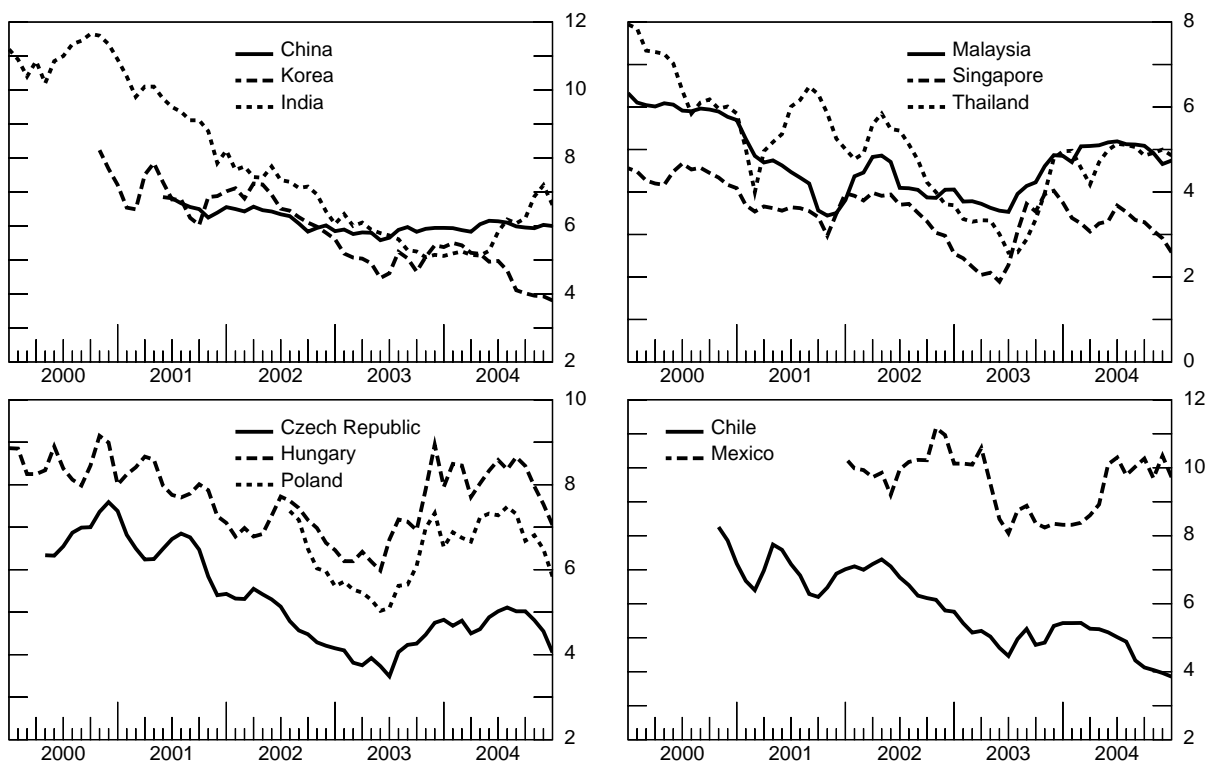
### 3. Three possible consequences of prolonged sterilised intervention

The sterilisation of prolonged or very large intervention *could* eventually have three consequences: it could undermine monetary objectives; it could compromise financial stability; and it could impose heavy financing costs on the monetary authorities. This section examines how far the current situation raises such risks.

Focusing on the first issue, the nature of monetary challenges in the current cycle has varied from the previous experience. In the past, inflation risks often meant the authorities were unwilling to countenance the lower short-term interest rates that intervention entailed. In the more recent episode, by contrast, many countries accumulating reserves actually wanted an easier monetary policy stance. Low inflation and large output gaps especially following the 2001 global economic slowdown had led many Asian central banks to cut interest rates to stimulate domestic demand. As a result, short-term interest rates have fallen or remained low throughout Asia during the past four years (Graph 3). The picture appears to be broadly similar in a number of countries in central Europe and Latin America. The decline in long-term bond rates has been even steeper, particularly in Korea, India and Singapore (Graph 4).

Graph 4

Long-term interest rates<sup>1</sup>



<sup>1</sup> Ten year treasury bond yields.

Source: National data.

An additional factor is that some countries, at least at the beginning of the current cycle, have seen greater risk aversion among banks, increasing their demand for safer assets and thus putting downward pressures on long-term bond rates. In India, for example, such a flight-to-quality behaviour has meant that banks have been more than willing to invest in government securities (or indeed other sterilisation instruments) at a low interest rate. By the middle of October 2004 banks held more than 39% of their total liabilities in government bonds, far exceeding the minimum statutory liquidity requirement of 25%. Such effects remain significant in several other economies in Asia (for example, Korea) and Latin America.



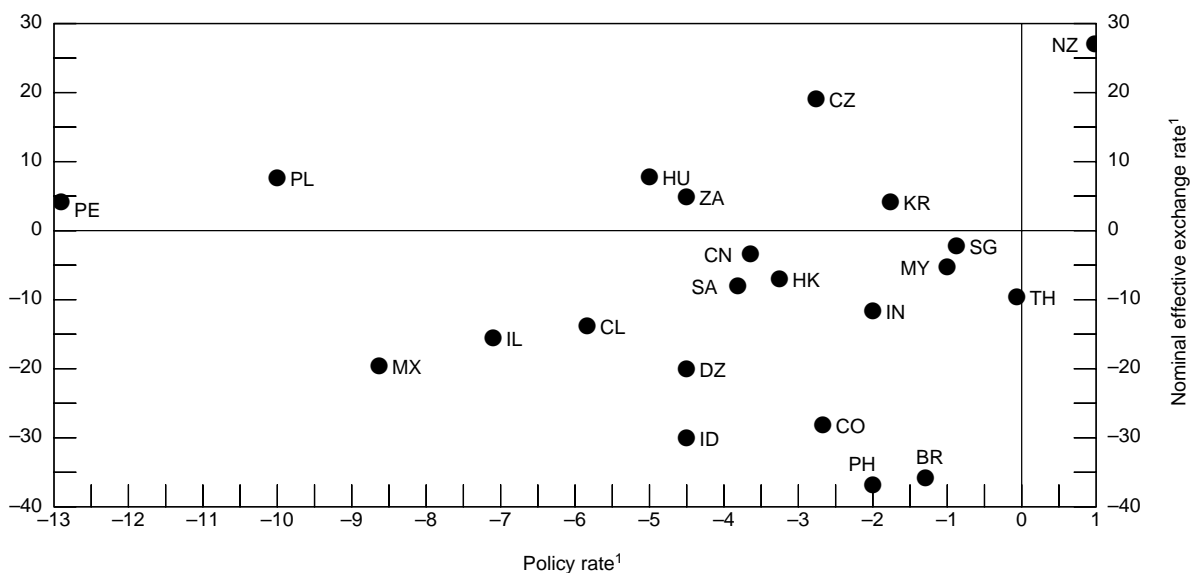
Third, domestic bond markets have grown larger and deeper in emerging market economies, further facilitating large-scale open market operations in many countries. While domestic bond markets were small during the early 1990s, they have grown in relation to GDP during the past few years. In Asia, for example, outstanding domestic government and central bank securities rose from less than 14% of GDP at the end of 2000 to 23% at the end of 2003. In Latin America and central Europe such ratios stood at 24% and 32%, respectively, at the end of 2004. This may have helped to alleviate some of the financial market imperfections which had constrained central banks' ability to sustain sterilised intervention in the past.

**(a) Risk of monetary imbalance**

Nevertheless, the combination of low interest rates and (in some cases) large effective depreciation of the exchange rate has meant that monetary conditions have been very expansionary in a very large number of countries in the current cycle (Graph 5). Most countries are in the third quadrant - policy rates were lowered *and* the currency depreciated in nominal effective terms.

Such a policy mix has several risks. At some point, the risk of inflation rises - even if globally inflation has been low in recent years. In China, the risk of overheating has remained a major concern during the past two years. The annual inflation rate steadily increased from a little over 1% at the end of 2003 to over 5% by the middle of 2004, before declining at the end of the year due to a sharp deceleration in food prices. Russia faced a similar situation last year as reserve accumulation to prevent appreciation of the rouble fuelled monetary growth and contributed to higher inflation in the economy. In India, a sharp increase in inflation over the past year (from 6% to 8% since July 2004) has brought a similar challenge into the picture. Many East Asian economies (Korea, Singapore and Thailand) have also recently seen upward price pressures.

Graph 5  
Policy mix



<sup>1</sup> Cumulative changes for the period 2000-04.

Source: National data.

Second, another potential risk could arise from the large-scale issuance of debt securities by central banks. In Korea, outstanding monetary stabilisation bonds, issued primarily for sterilisation operation by the central bank, more than doubled between 2000 and 2004 to constitute 300% of reserve money (see Annex Table A3). Such ratios have increased to over 200% in the Czech Republic, 150% in Israel and 50% in Malaysia and Mexico. In China, from their introduction in April 2003 outstanding central bank securities grew to 14% of the reserve money at the end September 2004. In the current

monetary accounting convention, central bank securities are excluded from both base money and the broader monetary aggregates. As such, their monetary impacts remain hidden. Nevertheless, they represent potential liquidity in the commercial banks' balance sheets - which the banks could use for supporting future lending operations. Moreover, interest payments on such securities will continue to fuel bank reserves, adding to the challenges for central banks' monetary management. In Korea recently, for instance, interest payments on monetary stabilisation bonds are reported to have matched their net issuance.<sup>14</sup>

Third, sterilisation securities in many countries tend to be shorter-term bills rather than longer-term bonds (Table 2). For instance, a large part of central bank securities in 2004 were concentrated in maturities of less than one year. In the Czech Republic, Israel, Malaysia, Peru and Thailand, sterilisation securities are primarily less than one year while in Korea they stretch out up to two years. Only a few countries, such as Chile, issue securities which go beyond three to five years. Short-term sterilisation debts expose the central bank and the government to rollover risks. Not only do they necessitate future liquidity-draining operations, but they would also raise future costs should domestic interest rates rise.

Table 2  
Maturity distribution of central bank securities<sup>1</sup>

|                              | Less than six months |       | Six months to one year |       | One year to three years |      | More than three years |       |
|------------------------------|----------------------|-------|------------------------|-------|-------------------------|------|-----------------------|-------|
|                              | 2000                 | 2004  | 2000                   | 2004  | 2000                    | 2004 | 2000                  | 2004  |
| Asia <sup>2,3</sup>          | 15.7                 | 13.2  | 27.8                   | 20.8  | 43.6                    | 36.1 | 12.9                  | 30.3  |
| Hong Kong SAR                | 42.7                 | 28.1  | 24.6                   | 27.8  | 11.0                    | 11.9 | 21.7                  | 32.2  |
| Korea                        | 0.0                  | 4.8   | 39.9                   | 16.7  | 59.8                    | 65.8 | 0.3                   | 12.7  |
| Philippines                  | 0.0                  | 0.0   | 0.0                    | 5.9   | 52.1                    | 0.0  | 47.9                  | 94.1  |
| Malaysia                     | 73.5                 | 50.5  | 26.5                   | 51.6  | 0.0                     | 0.0  | 0.0                   | 0.0   |
| Thailand                     |                      | 0.0   |                        | 100.0 |                         | 0.0  |                       | 0.0   |
| Latin America <sup>2,4</sup> | 6.1                  | 3.9   | 2.7                    | 13.5  | 81.0                    | 35.6 | 10.0                  | 46.7  |
| Brazil                       | 0.0                  | 0.0   | 1.9                    | 0.0   | 89.0                    | 15.9 | 9.1                   | 84.1  |
| Chile                        | 22.3                 | 13.8  | 11.4                   | 1.2   | 4.9                     | 26.7 | 61.3                  | 58.3  |
| Mexico                       | 0.0                  | 0.0   | 0.0                    | 30.3  | 100.6                   | 69.2 | 0.0                   | 0.0   |
| Peru                         | 78.6                 | 50.8  | 14.3                   | 44.3  | 0.0                     | 3.3  | 0.0                   | 0.0   |
| Venezuela                    |                      | 100.0 |                        | 0.0   |                         | 0.0  |                       | 0.0   |
| Central Europe <sup>2</sup>  | 56.3                 | 29.4  | 22.8                   | 22.8  | 0.0                     | 0.0  | 20.9                  | 47.7  |
| Czech Republic               | 0.0                  | 0.0   | 100.0                  | 100.0 | 0.0                     | 0.0  | 0.0                   | 0.0   |
| Hungary                      | 100.0                | 0.0   | 0.0                    | 0.0   | 0.0                     | 0.0  | 0.0                   | 100.0 |
| Poland                       | 63.8                 | 50.9  | 0.0                    | 0.0   | 0.0                     | 0.0  | 36.2                  | 49.1  |
| Israel                       |                      | 25.7  |                        | 74.3  |                         | 0.0  |                       | 0.0   |
| South Africa                 | 100.0                | 100.0 | 0.0                    | 0.0   | 0.0                     | 0.0  | 0.0                   | 0.0   |

<sup>1</sup> As a percentage of total central bank securities outstanding; end of year. For 2004, data pertains to various months as reported by the central banks up to November 2004. <sup>2</sup> Average of the economies shown. <sup>3</sup> Excluding Thailand. <sup>4</sup> Excluding Venezuela.

Source: National data.

<sup>14</sup> In countries which use government bonds rather than central bank securities for sterilisation operations, large sterilisation operations create debt servicing obligations that impact government budgets. In the absence of offsetting fiscal adjustments, such payments have potential expansionary implications by raising government spending and the fiscal deficit.

## (b) Risks to the financial sector

Interventions could also accentuate financial imbalances. One possible channel is that *increased bank lending* resulting from ineffective sterilisation could finance excessive investment in certain sectors such as equity and property markets. And a large overhang of excess liquidity might make banks too willing to accommodate demand for such credit. Moreover, banks which have accumulated large amounts of risk-free assets may be keen to invest in riskier assets that promise higher returns. Some have argued that reserve accumulation sends a signal that central banks have ample foreign exchange assets to support local banks should the need arise. This may, in effect, reduce the probability of future default and thus relax financing constraints on firms. The possible public provision of international liquidity may lead firms to become more relaxed in their assessment of risk and respond by increasing foreign currency borrowing to finance riskier investments even in non-tradable sectors (see Caballero and Krishnamurthy (2000)).<sup>15</sup>

Are there signs of any such risks at present? This is difficult to assess. One important trend in many countries is that banks have sharply raised their lending to households to finance consumption and housing investment. In many Asian economies mortgage and housing credit has been rising by 15 to 30% a year during the past two years (Table 3).<sup>16</sup> In some countries such a development has been associated with strong increases in property prices. Korea has already seen a boom-and-bust credit cycle last year. Rapid growth in consumer credit in 2001 and 2002 sharply raised default rates, creating financial distress for a number of credit card companies. The economy has slowed considerably since 2003 as households reduced consumption and banks cut lending. Thailand avoided a similar situation early this year with authorities tightening lending norms for consumer and property market lending. In China, a sharp acceleration of lending to the residential and commercial housing sectors in the past two years was followed by the imposition of regulatory restrictions on bank lending. Many Latin American and central European countries have also seen faster growth in household lending in recent years.

A second possible channel is through the impact on investors' *exchange rate expectations*. Expectations of future appreciation, for instance, can attract larger capital inflows, pushing equity and bond prices too high. The economy is left more vulnerable to a subsequent reversal of inflows and a collapse of the exchange rate and other asset prices. There is at present no decisive evidence that a substantial rise in short-term inflows has created major vulnerabilities in the current cycle. There is, nevertheless, some evidence that their role may have remained significant in several recent episodes. For instance, a sharp increase in equity inflows to several Asian economies during the past two years was seen by many as investors' reaction to profit opportunities arising from expected currency appreciation. Another indicator of such expectations was the large negative long-term interest rate differential seen by many Asian economies during the periods of peak inflows and sterilised interventions (BIS (2004)). Last year India saw a rise in unhedged corporate borrowing, leading to the introduction of a regulatory requirement for firms to hedge their foreign currency exposures. The recent sharp increase in short-term inflows (and perhaps transfers) to China has been associated with the expectation of a possible future revaluation of the fixed exchange rate.

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<sup>15</sup> Caballero and Krishnamurthy (2000) show that the basic mechanism through which this happens is financial market deficiencies rather than moral hazard risk. When domestic bond markets are illiquid, issuance of sterilisation debt leads to a liquidity mismatch in the central bank's balance sheet. Since the central bank cannot redeem these securities easily and commits to supply reserves in the event of a crisis, it has, in effect, given support to domestic asset prices, effectively lowering the cost of capital for firms.

<sup>16</sup> It is important to recognise that a relatively faster rate of increase in household credit has played a major role in recovery in domestic demand in Asia following the 1997-98 financial crisis. Such a development may also reflect stronger demand for credit led by recent liberalisation of restrictions on banks to lend to households and relatively weak credit demand from business sector. As such, not all credit expansion to households is undesirable.

Table 3

**Household credit and residential property prices<sup>1</sup>**

|                             | Mortgage credit <sup>2</sup> |       |       | Consumer credit <sup>2</sup> |       |      | Residential property price |      |      |
|-----------------------------|------------------------------|-------|-------|------------------------------|-------|------|----------------------------|------|------|
|                             | 2002                         | 2003  | 2004  | 2002                         | 2003  | 2004 | 2002                       | 2003 | 2004 |
| Asia <sup>3</sup>           | 3.9                          | 18.7  | 15.8  | 13.6                         | 22.3  | 19.9 | 2.1                        | 7.4  | 8.7  |
| Hong Kong SAR               | 0.8                          | -2.1  | -2.0  | -2.4                         | -1.8  | 1.4  | -11.8                      | -1.1 | 27.0 |
| Indonesia                   | -0.6                         | 31.6  | 23.3  | 24.2                         | 33.6  | 27.6 | 7.6                        | 11.0 | 6.2  |
| Philippines                 | -0.0                         | -3.0  |       | 20.2                         | 3.9   |      | 0.8                        | 0.8  |      |
| Singapore                   | 6.8                          | 16.3  | 14.9  | -0.8                         | 17.0  | 2.9  | -1.8                       | -2.0 | -0.8 |
| Thailand                    | 11.0                         | 16.5  | 14.1  | 20.3                         | 19.1  | 19.3 | 7.6                        | 18.5 | 16.7 |
| Taiwan, China               | 4.5                          | 10.2  | 13.4  | 1.4                          | 19.4  | 20.3 | -4.6                       | -2.3 | 0.4  |
| Latin America <sup>4</sup>  | -14.1                        | -8.6  | -7.3  | -1.0                         | 12.9  | 23.9 |                            |      |      |
| Argentina                   | -52.3                        | -19.0 | -15.6 | -60.1                        | -14.1 | 21.7 |                            |      |      |
| Brazil                      | -10.6                        | -4.8  | -3.7  | -6.1                         | 5.5   | 16.1 |                            |      |      |
| Chile                       | 4.4                          | 9.4   | 1.3   | 8.8                          | 10.3  | 20.5 |                            |      |      |
| Colombia                    | -10.4                        | -11.7 | -12.8 | -0.7                         | 16.4  | 20.4 | -13.9                      | 8.4  | 4.3  |
| Mexico                      | -11.4                        | -15.4 | -11.3 | 28.0                         | 34.5  | 39.4 | -2.6                       | -1.5 |      |
| Peru                        | 11.3                         | 10.6  | 10.7  | 9.8                          | 13.4  | 10.8 |                            |      |      |
| Central Europe <sup>4</sup> | 83.6                         | 66.3  | 61.8  | 55.4                         | 16.4  | 12.1 |                            |      |      |
| Czech Republic              | 44.7                         | 52.7  | 56.3  | 86.9                         | 16.5  | 9.5  |                            |      |      |
| Hungary                     | 129.6                        | 82.5  | 68.3  | 18.2                         | 16.3  | 15.2 |                            | 15.3 | 10.0 |
| Russia                      | 78.4                         |       |       | 28.6                         |       |      | 22.5                       | 18.8 |      |
| South Africa                | -2.3                         | 12.8  | 14.4  | -1.7                         | 7.6   | 7.4  | 17.0                       | 19.4 | 25.1 |

<sup>1</sup> Annual changes, in per cent; end of year. For 2004, up to second quarter. Definitions of the series may vary across countries. <sup>2</sup> In real terms. Deflated by consumer price inflation. <sup>3</sup> Average of economies shown excluding the Philippines.

<sup>4</sup> Average of countries shown.

**(c) Cost of intervention**

An earlier presumption has been that intervention entails large running costs because emerging market countries' assets typically have higher yields than those of industrial countries. And such costs have indeed been very high in the past. In Chile, for example, the annual loss to the central bank from foreign exchange market intervention was estimated to have risen to about 0.5% of GDP during 1990 to 1993 (Velasco and Cabezas (1999)). The policy of resisting appreciation was ultimately abandoned.

During the current episode, by contrast, low domestic interest rates have reduced the carrying costs of reserves in many countries. Table 4 presents illustrative estimates of carrying costs obtained by applying the difference between the interest rate on one-year domestic treasury bonds (or central bank bills) and that for a comparable US Treasury security to annual changes in the domestic currency value of reserves.<sup>17</sup> The table also reports, where available from central bank sources, the net revaluation effect, which is the difference between the revaluation losses or gains from foreign currency assets and that on foreign currency liabilities in the central bank portfolio.

<sup>17</sup> It is important to recognise that estimates of sterilisation costs are very sensitive to the assumption about the interest rate.

Over the period 2000-03 as a whole, carrying costs appear to have been below 0.5% of GDP in most countries. With the domestic bond rate at or below the US Treasury rate, some countries (for instance China and Singapore) have even seen net gains rather than losses in accumulating reserves in some years. In some others (for instance Hungary and South Africa), negative carrying costs in some years reflect a decline in reserve levels rather than negative interest rate differentials. In Brazil and Turkey, given their high interest rate differentials, carrying costs have been relatively high, although they fell sharply in the latter in 2003.

Table 4  
**Intervention: estimates of the carrying costs  
and valuation effects of changes in reserves**

|                | Carrying cost <sup>1</sup> |       |       |       | Net valuation effect <sup>2</sup> |       |       |       |
|----------------|----------------------------|-------|-------|-------|-----------------------------------|-------|-------|-------|
|                | 2000                       | 2001  | 2002  | 2003  | 2000                              | 2001  | 2002  | 2003  |
| Asia           |                            |       |       |       |                                   |       |       |       |
| China          | -0.04                      | -0.05 | 0.00  | 0.06  |                                   |       |       |       |
| Hong Kong SAR  | 0.02                       | 0.01  | 0.00  | 0.01  | -0.87                             | -1.03 | 2.18  | 1.88  |
| India          | 0.05                       | 0.09  | 0.19  | 0.17  |                                   |       |       |       |
| Indonesia      | 0.42                       | 0.42  | 0.10  | 0.10  | -0.21                             | 0.00  | -0.00 | 0.00  |
| Korea          | 0.06                       | 0.07  | 0.09  | 0.14  |                                   |       |       |       |
| Malaysia       | 0.03                       | -0.01 | 0.04  | 0.16  |                                   |       |       |       |
| Philippines    | 0.10                       | 0.25  | -0.00 | 0.08  | 0.00                              | 0.00  | 0.00  | 0.00  |
| Singapore      | -0.16                      | 0.03  | -0.04 | -0.03 |                                   |       |       |       |
| Latin America  |                            |       |       |       |                                   |       |       |       |
| Brazil         | -0.04                      | 0.38  | 0.43  | 0.74  | -1.06                             | -0.84 | 2.19  | -0.98 |
| Chile          | -0.02                      | 0.01  | -0.00 | 0.00  | 1.73                              | 3.11  | 2.80  | -3.64 |
| Mexico         | 0.07                       | 0.14  | 0.07  | 0.12  | -0.00                             | 0.00  | -0.01 | 0.00  |
| Central Europe |                            |       |       |       |                                   |       |       |       |
| Czech Republic | -0.01                      | 0.03  | 0.15  | -0.01 |                                   |       |       |       |
| Hungary        | 0.16                       | -0.06 | -0.19 | 0.07  | 0.58                              | 0.37  | -0.02 | 0.48  |
| Poland         | 0.19                       | -0.16 | 0.10  | 0.05  |                                   |       |       |       |
| Israel         | 0.01                       | 0.02  | 0.16  | 0.06  | -0.78                             | 0.02  | 0.19  | 0.50  |
| New Zealand    | -0.00                      | -0.00 | 0.01  | 0.03  |                                   |       |       |       |
| South Africa   | 0.01                       | 0.06  | 0.08  | -0.10 |                                   |       |       |       |
| Turkey         | 0.98                       | 2.79  | 3.50  | 1.26  | 1.00                              | 3.99  | 0.42  | -0.20 |

<sup>1</sup> Calculated as the spread between the domestic and the US one-year treasury bill interest rate, applied to the change in foreign exchange reserves in domestic currency, as a percentage of GDP, in the year shown. <sup>2</sup> Difference between the exchange rate revaluation effects on assets and liabilities of the central bank, denominated in foreign currency.

Sources: National data; BIS calculations.

The cost calculations in Table 4 do not capture own-currency capital gains or losses, which remain a major additional element of the overall return from central banks' assets. These have been much larger during the recent period. Increased prices on US dollar bonds may have boosted capital gains from foreign currency assets, adding to the return from such assets. A comparison of average returns from domestic and foreign assets brings out the importance of this factor (Mohanty and Scatigna (2005)). In Hong Kong and Israel, for instance, the negative return on domestic assets (over 12% and 51%, respectively) in 2002 was fully or partly offset by the positive return from foreign assets. In Korea and

Chile, the average return on the central bank's foreign currency assets exceeded that on domestic assets by a factor of 2 and 10 percentage points, respectively, during the same year.

#### 4. Choice of instruments

A specific aspect of sterilised intervention in the current cycle has been the challenge for monetary authorities in finding instruments to withdraw excess liquidity. Some central banks have had too few instruments (and so introduced new measures to drain liquidity), while others have increased issuance of their own securities. Such developments raise four issues. What factors determine the choice between market and non-market instruments? What market instruments should be used? What are the implications of issuing central bank securities as against government bonds for sterilisation operations? What role have other policies played in dealing with such pressures and how effective are they?

##### Market vs non-market instruments

Instruments that have a high degree of marketability, such as government and central bank paper, are generally more suitable than non-market instruments because they help central banks to withdraw liquidity without adversely affecting the depth of the financial markets and without distorting the capacity of financial institutions to intermediate credit.

In the past, however, some central banks have found that the price response on market instruments in thin markets can be uncomfortably large - much larger than would be the case in deeper markets. When local bond rates rose sharply, for instance, there was greater recourse to non-market instruments for sterilisation operations. For example, during the early 1990s episode of capital inflows, many East Asian economies transferred large amounts of provident fund deposits from the banking system to the central bank at below market interest rates.<sup>18</sup> Malaysia and the Czech Republic sharply raised reserve requirements, and Indonesia imposed a 15% tax on interest payments by banks and introduced direct credit control measures.<sup>19</sup> The drawbacks of non-market instruments are well known. Reserve requirements effectively tax the banking system, and thus encourage financial disintermediation. Any attempt to pass on the cost to borrowers might encourage firms to borrow abroad, defeating the very purpose of sterilised intervention. The compulsory transfer of public institutions' deposits - especially when not remunerated at the market rate - forces these institutions to bear a part of the sterilisation costs.

As Table A4 in the Annex shows, during the current cycle most countries have used a number of market and non-market instruments - often in concert - for sterilising their foreign exchange market interventions. But it is striking that a preference for market instruments does seem to be becoming well established. Such a development may partly reflect the fact that interest rates remain low in most countries despite the large-scale open market operations, obviating any need for exceptional measures for exercising monetary control.

Nevertheless, there have been notable differences across countries, particularly those witnessing a large growth in foreign currency reserves. Korea has largely relied on market instruments for sterilisation.<sup>20</sup> The two large Asian economies - China and India - have used a mix of market and non-market instruments. In China, open market operations in bonds have been important. But the People's Bank of China also raised reserve requirements by 1 percentage point in September 2003 and again by 1/2 percentage point in April 2004. In addition, the fact that the central bank remunerated the excess reserves of commercial banks induced the banks to willingly hold large amounts of cash

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<sup>18</sup> See Reisen (1993) and Griffith-Jones et al (2001) for a discussion on East Asian experience.

<sup>19</sup> See Nasution (2001) for an extensive discussion of the policy challenges confronted by Bank Indonesia in the early 1990s.

<sup>20</sup> In Korea, monetary stabilisation bonds issued by the central bank constitute the key instrument of sterilisation, although such an instrument was first introduced as a monetary policy instrument and not specifically as a sterilisation device. Such sterilisation effort was also helped by the fact that government intervened on its own account by issuing dollar-denominated liabilities, using its so-called foreign exchange stabilisation fund; see the paper by Rhee (in this volume).

balances with the central bank. These measures were supplemented by direct lending restrictions in early 2004 to contain credit growth to the overheated sectors. In India, although open market operations have been the principal instrument for sterilisation, the central bank also raised reserve requirements by 0.5 percentage points in September 2004 to control rapid growth in the money supply. The central bank has not ruled out using such an instrument solely for sterilisation purposes under exceptional circumstances.

### Which market instrument?

The three major market instruments are long-term bonds, shorter-term instruments such as swaps and repos, and direct borrowing from banks at market interest rates.

Central banks may face a trade-off in issuing longer-term vs shorter-term securities. It is well recognised that long-term bonds issued to non-banks are the most effective way of draining liquidity from the banking sector - and so constraining bank lending. Hence this is particularly useful during episodes of prolonged forex inflows/intervention. And the interest rate risk is transferred to the private non-bank sector.

However, the investor base in many countries is narrow. As a result, sterilisation securities are mostly sold to banks. But by choosing to issue longer-maturity bonds central banks can reduce the rollover problem and exposure to interest rate risks associated with shorter-term bills. The consequences of higher or lower policy rates then fall squarely on the private sector - enhancing the efficacy of monetary policy. For example, in China the central bank has announced the issue of three-year securities beginning in 2005 with a view to lengthening the maturity of sterilisation bonds. To the extent that such bonds replace the shorter-term central bank bills, they could have a longer-term impact on the excess liquidity in the banking system, thereby enhancing monetary control.

On the other hand, issuing long-term bonds could prove to be expensive - especially if the yield on such bonds incorporates a significant inflation risk. Moreover, in the case of temporary forex inflows, instruments such as repurchase operations and foreign exchange swaps might be preferred. They might also increase the flexibility of monetary operations. While central banks might run up intervention-related debts during an inflow cycle, they can run them down during periods of heavy outflows and depreciation pressures on the exchange rate.

Singapore provides a good example of the use of swap and repo operations for sterilised intervention. Prior to 1998, the Monetary Authority of Singapore largely depended on foreign exchange swaps and uncollateralised deposit facilities for its liquidity operations. But with the volume of liquidity operations rising sharply and exposing the central bank to significant counterparty risk, it introduced repurchase operations on government paper. Given a highly developed swap market, the central bank uses foreign exchange swaps for longer-term withdrawal of liquidity but repurchase transactions for more short-term liquidity operations. With the economy witnessing very large capital inflows during September and October 2003, the central bank drained excess liquidity of around 8% of its liability base by using a combination of repos, swaps and deposit facilities; see Tee (2005).

A final instrument, used extensively by many countries in this cycle, is direct borrowing by the central bank from commercial banks through an overnight deposit facility.<sup>21</sup> In Malaysia, direct borrowing by the central bank constitutes the single most important instrument for sterilising excess liquidity (accounting for over 69% of the monetary base). Another example of extensive use of such an instrument is Hungary.<sup>22</sup> The speculative attack on the forint on the strong edge of the band in January 2004 resulted in very large capital inflows over a span of few days (about EUR 5 billion in two days). While intervening in the foreign exchange market the central bank absorbed most of the excess liquidity through the overnight and two-week deposit facility offered to banks. At the same time, the central bank sharply cut the interest rate on overnight deposits to reduce the profitability of speculators. The central bank in the Philippines uses its tiering deposit system (interest rates varying with the amount of the deposit) as an instrument for sterilising interventions. Similarly, the central bank

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<sup>21</sup> The treatment of such deposits, however, differs; some central banks have classified them as non-market instruments and some have not.

<sup>22</sup> See the paper by Érsék in this volume.

of Mexico offers a special deposit facility to banks at market interest rates to withdraw long-term liquidity from the banking system.

### **Government vs central bank securities**

From the perspective of the consolidated budget of the public sector, the distinction between government and central bank securities would seem unimportant - as both are official sector liabilities. Nevertheless, there may be reasons for preferring one form of issuance over another. In any event country approaches to the use of government or central bank paper for sterilisation have differed considerably. Three such approaches are discernible. First, a majority of central banks issue their own securities rather than depending on their governments to issue such paper (Annex Table A4).

A second approach followed by some central banks (for instance New Zealand, the Philippines and Singapore) has been to depend exclusively on government issuance for sterilisation operations. A recent striking example is the Reserve Bank of India, which, despite facing a shortage of securities, preferred not to issue its own securities. Under a new monetary stabilisation scheme (MSS) introduced in April 2004, the central government started issuing additional securities, over and above its borrowing requirement, exclusively for sterilisation operations.<sup>23</sup>

A third approach has been to use both government and central bank paper. In Mexico, the market for both types of paper has grown simultaneously in the past few years. In Malaysia, the central bank has sparingly used its own securities for sterilisation operations - mostly for withdrawing longer-term liquidity - while the government issues its own bonds for financing deficits. Similar models are seen across a number of emerging market economies (eg the Czech Republic, Hungary and South Africa).

There might be several reasons for relying on central bank paper. One is that central banks in countries where governments have historically run fiscal surpluses may lack a stock of government bonds for conducting even daily monetary policy operations. Chile and Hong Kong provide two such examples. Another explanation may be that central banks that are partly or fully responsible for managing the exchange rate might prefer to issue their own securities to finance intervention.

A third reason is that governments may be unwilling to show sterilisation costs in their budgets for fear of raising the fiscal deficit and facing the prospects of substantial credit downgrades. These sterilisation costs can be large. If securities are issued in large volumes to cover intervention, the carrying cost of intervention can rise sharply as borrowing costs outstrip interest income on the foreign reserve assets accumulated in intervention. Locating those sterilisation costs in the central bank's books might also be seen to have presentational advantages.

For the central bank, however, not only would income substantially be reduced, but local currency interest rate risks could also rise. Duration mismatches increase as central banks issue shorter-term obligations to finance their longer-term foreign currency investment. Such a trend might also be reinforced by the authorities' investment policy. For example, the attempt to minimise the net running cost of holding reserves may lead the monetary authorities to increase the benchmark duration of foreign currency assets but issue more short-term local securities. Such a strategy could lengthen the average duration of foreign currency assets while reducing that of their local currency debt securities.

According to some limited (and unpublished) data available for a few central banks, the nature of the maturity mismatch problem differs across countries (Table 5). For instance, in the case of one central bank all outstanding securities were below one year, while it held about three quarters of its foreign currency assets in short-term maturities. In another case, the mismatch was the reverse. The central bank held about 70% of its foreign currency assets at less than one year to maturity by funding part of them through bonds of more than three-year maturity. It is possible, however, that duration mismatches are much higher than the data in Table 5 suggest - particularly for large reserve holders in Asia where such data are not available.

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<sup>23</sup> One technical limitation in the Reserve Bank's case is that legislation does not permit it to issue its own liabilities. Such a legal constraint is related to the fact that under its Act, the RBI cannot borrow beyond its paid-up capital without collateral, hence permitting only repo and outright operations on government securities; see RBI (2004a).



Whether the government or the central bank should bear the financing costs of reserve accumulation is debatable. Some have argued that what matters for confidence and monetary stability is the net worth of the combined government and central bank, which depends on the consolidated balance sheet of the public sector. If governments have to issue debt or borrow from the central bank to finance the sterilisation cost, its impacts will be similar to central bank recapitalisation.

Table 5

**Maturity distribution of central banks' assets and liabilities in 2004<sup>1</sup>**

|     | Gross foreign assets |                        |                         |                       | Central bank securities |                        |                         |                       |
|-----|----------------------|------------------------|-------------------------|-----------------------|-------------------------|------------------------|-------------------------|-----------------------|
|     | Less than six months | Six months to one year | One year to three years | More than three years | Less than six months    | Six months to one year | One year to three years | More than three years |
| CB1 | 40.4                 | 39.1                   | 20.5                    | 0.0                   | 0.0                     | 0.0                    | 15.9                    | 84.1                  |
| CB2 | 43.2                 | 30.1                   | 21.0                    | 5.6                   |                         |                        |                         |                       |
| CB3 | 53.8                 | 10.3                   | 25.6                    | 10.3                  | 50.8                    | 44.3                   | 3.3                     | 0.0                   |
| CB4 | 54.9                 | 20.2                   | 24.5                    | 0.0                   | 0.0                     | 100.0                  | 0.0                     | 0.0                   |
| CB5 | 35.0                 | 36.0                   | 21.0                    | 8.0                   | 0.0                     | 0.0                    | 0.0                     | 100.0                 |
| CB6 | 84.0                 | 2.1                    | 2.3                     | 11.5                  |                         |                        |                         |                       |
| CB7 | 88.5                 | 4.8                    | 5.8                     | 1.0                   | 100.0                   | 0.0                    | 0.0                     | 0.0                   |

<sup>1</sup> As a percentage of total gross foreign assets and central bank securities, respectively. In some cases the maturity assignment given in the replies to the questionnaires did not meet entirely the maturity classification as shown in the table.

Source: National data.

Others argue that preserving the operational autonomy of central banks and the soundness of their balance sheet remains a key condition for their operational effectiveness. Such an argument, for example, is demonstrated by the intervention strategy recently announced by the Reserve Bank of New Zealand; see RBNZ (2004). The Bank has asked the government to enhance its capital base to enable it to sustain possible short-term losses from intervention.<sup>24</sup> It has argued that such a strategy will ensure its operational independence from political process and other economic objectives that may be more short-term.

Likewise, for good governance it would seem appropriate that interventions directed by the government should be borne in a transparent way by the government. Showing the costs of intervention - ultimately a claim on the taxpayer - in the budget would promote such transparency and facilitate parliamentary scrutiny. India's recent approach illustrates this point well. Under the newly introduced monetary stabilisation scheme the central government is committed to issue bonds up to a fixed amount (initially INR 600 billion but increased subsequently to INR 800 billion) and keep the proceeds as a non-interest bearing special deposit with the RBI. The entire servicing cost will appear in the government's budget. Such an arrangement ensures that the government's additional debt is fully backed by a cash deposit for redeeming these market liabilities - making clear that *net* debt has not risen. At the same time, it shifts part of the financial burden of intervention to the government in a very transparent way, subjecting such financing to parliamentary review.<sup>25</sup>

<sup>24</sup> The memorandum submitted by the Reserve Bank of New Zealand to the Minister of Finance in March 2004 outlines the total financial requirement for implementing intervention. It includes NZD 1.9 billion to increase the Bank's total stock of foreign currency reserve and up to NZD 1.0 billion as additional capital base; see RBNZ (2004).

<sup>25</sup> See RBI (2004b) and Kapur (2004) for the details about the MSS scheme.

A further argument for issuance of government rather than central bank securities has a financial market angle. To the extent that local bond markets in emerging economies continue to be relatively illiquid, issuing large amounts of central bank securities could fragment the market, further reducing liquidity. Moreover, such a strategy might force market players to differentiate credit ratings of two sovereign entities, giving rise to significant distortions in their yields. Table 6, for instance, compares the monthly average yields on government and central bank securities of similar duration during January-August 2004 for three countries. Yield differences in basis points continue to be significant in some cases. Such differences might reflect several factors, such as the relative benchmark status of two types of securities, their differential tax treatments and even their different investor base. Nevertheless, such differences also imply that impacts of consolidating both issues on bond market liquidity can be substantial in some countries.

Table 6  
Yields on government and central bank securities<sup>1</sup>

|        | Chile                   |                           | Malaysia                |                           |
|--------|-------------------------|---------------------------|-------------------------|---------------------------|
|        | Government <sup>2</sup> | Central bank <sup>3</sup> | Government <sup>4</sup> | Central bank <sup>5</sup> |
| Jan 04 | 4.86                    | 4.90                      | 2.66                    | 2.73                      |
| Feb 04 | 4.59                    | 4.61                      | 2.38                    | 2.34                      |
| Mar 04 | 4.32                    | 4.36                      | 2.48                    | 2.48                      |
| Apr 04 | 4.60                    | 4.56                      | 2.41                    | 2.37                      |
| May 04 | 4.63                    | 4.57                      | 2.48                    | 2.53                      |
| Jun 04 | 4.60                    | 4.61                      | 2.54                    | 2.55                      |
| Jul 04 | 4.46                    | 4.45                      | 2.39                    | 2.36                      |
| Aug 04 | 4.06                    | 4.05                      |                         |                           |

<sup>1</sup> Monthly averages. <sup>2</sup> Twenty-year treasury bonds. <sup>3</sup> Twenty-year central bank bonds. <sup>4</sup> Average of midpoints of monthly ranges of three-month and six-month treasury bills. <sup>5</sup> Average of midpoints of monthly ranges of three-month and six-month central bank bills.

One suggestion has been that the central bank and government might issue securities of different maturities, reducing the problem of multiple yield curves. Korea has adopted such a strategy. The Bank of Korea's monetary stabilisation bond commonly stretches out to three years whereas the government has issued primarily long term securities. Another suggestion proposed by McCauley (2003) is that the government might supply the required securities to the central bank by overfunding its fiscal operations and depositing the cash with the central bank. This is in effect the approach taken in India, albeit for somewhat different reasons.

### Capital account measures

Another response to upward pressure on the currency has been to relax capital account restrictions.<sup>26</sup> During the early 1990s capital inflows episode, many Latin American and Asian countries (notably Mexico, Brazil, Malaysia, Chile and Korea) eased restrictions on capital outflows. In the current cycle, the authorities in China have announced several measures to encourage outflows. These have included: relaxing residents' overseas travel restrictions; promoting a qualified domestic investor scheme for encouraging outward portfolio investment; allowing domestic firms to issue foreign currency denominated bonds in the local market; and increasing the limit on firms' direct investment

<sup>26</sup> There is, nevertheless, some evidence to show that liberalising capital outflows may not succeed in reducing net inflows, especially if such liberalisation boosts the confidence of international investors, leading to more inflows; see Labán and Larraín (1994).

abroad. India has announced a comprehensive set of measures that aim to promote outward portfolio investment by residents, and encourage companies to prepay their external debt. Many countries (eg India and Thailand) have reduced their official sector debt by prepaying loans to international creditors.

In some cases, such outflow liberalisation has gone hand in hand with continuing or even new restrictions on inflows. Last year the authorities in Thailand restricted non-resident baht deposits in the banking system to counter appreciation pressures. Limitations were also placed on domestic financial institutions' capacity to lend to non-residents. In others, such restrictions apply to non-resident investment in the domestic bond market either prohibiting certain types of investors (eg India) or placing a minimum holding period for their investments (eg Colombia and Poland).

Whether such restrictions provide effective protection against speculative inflows remains an open question. The recent growth of non-deliverable forward markets in many Asian currencies is one demonstration of how such controls can be evaded. The paper by Rhee for this meeting shows the challenges faced by the Korean authorities from the offshore NDF markets on the won. A sharp rise in NDF transactions between the onshore banks and non-residents during the past four years has exaggerated won/dollar exchange rate volatility - non-residents buying (selling) dollars results in dollar short (long) positions of onshore banks in the spot market causing the won to depreciate (appreciate). To prevent such volatility the authorities in Korea imposed restrictions on the onshore entities' lending and borrowing activities with offshore participants in the NDF market in January 2004. With the exchange rate stabilising the restrictions have been partly reversed in recent months. Moreover, as the experience of Singapore demonstrates, such restrictions are not without costs - they tend to reduce the depth of domestic financial markets; in particular, they may prevent the authorities' attempts to develop a domestic bond market. For these reasons, the Monetary Authority of Singapore has recently substantially eased such restrictions.

## **5. Conclusion**

The recent episode of prolonged, substantial intervention is not yet over. It is unclear how far the levels of foreign exchange reserves now held by some monetary authorities represent a quasi-permanent shift in desired holdings. If not, then at some point in the future such monetary authorities will presumably seek to intervene in the opposite direction. But by how much and how fast cannot be predicted. Nor can the consequences of such a reversal be foreseen. But it does seem unlikely that the circumstances prevailing over the past five years, which have been so favourable to intervention - notably low inflation and financial markets' acquiescence in large current account imbalances - will last for ever. The policy dilemmas associated with conventional wisdom would then resurface.

## Annex

Table A1  
Capital flows and intervention<sup>1</sup>

|                             | Net capital flows |         |                      | Current account balance |         |                      | Change in reserves |         |                      |
|-----------------------------|-------------------|---------|----------------------|-------------------------|---------|----------------------|--------------------|---------|----------------------|
|                             | 1990-93           | 1995-96 | 2000-04 <sup>3</sup> | 1990-93                 | 1995-96 | 2000-04 <sup>3</sup> | 1990-93            | 1995-96 | 2000-04 <sup>3</sup> |
| Asia, large <sup>2</sup>    | 46                | 119     | 350                  | 28                      | -18     | 354                  | 18                 | 47      | 649                  |
| China                       | 35                | 79      | 234                  | 20                      | 9       | 189                  | -7                 | 5       | 398                  |
| India                       | 20                | 16      | 63                   | -18                     | -12     | 8                    | 9                  | 3       | 69                   |
| Korea                       | 20                | 41      | 37                   | -14                     | -32     | 58                   | 5                  | 32      | 71                   |
| Taiwan                      | -29               | -17     | 16                   | 39                      | 17      | 99                   | 11                 | 7       | 111                  |
| Asia, other <sup>2</sup>    | 81                | 70      | -206                 | -32                     | -40     | 285                  | 75                 | 16      | 88                   |
| Hong Kong SAR               |                   |         | -55                  | 26                      | -8      | 46                   | 18                 | -3      | 7                    |
| Indonesia                   | 22                | 21      | -17                  | -12                     | -14     | 32                   | 4                  | 6       | 8                    |
| Malaysia                    |                   |         | -16                  | -10                     | -13     | 48                   | 17                 | 5       | 26                   |
| Philippines                 | 11                | 17      | -15                  | -8                      | -6      | 18                   | 4                  | 2       | -1                   |
| Singapore                   | 7                 | -9      | -77                  |                         | 29      | 106                  | 21                 | 4       | 37                   |
| Thailand                    | 41                | 41      | -26                  | -28                     | -28     | 35                   | 11                 | 3       | 11                   |
| Latin America <sup>2</sup>  | 128               | 100     | 77                   | -86                     | -64     | -67                  | 57                 | -10     | 44                   |
| Argentina                   | 22                | 17      | -52                  | -10                     | -12     | 6                    | 9                  | 2       | 2                    |
| Brazil                      | 3                 | 63      | 46                   | 1                       | -41     | -42                  | 23                 | -8      | 14                   |
| Chile                       | 7                 | 8       | 2                    | -4                      | -4      | -2                   | 4                  | -2      | 1                    |
| Colombia                    |                   | 7       | 7                    |                         | -5      | -4                   | 3                  | -1      | 2                    |
| Mexico                      | 94                | 3       | 94                   | -70                     | -4      | -64                  | 15                 | 3       | 17                   |
| Peru                        | 1                 | 8       | 7                    | -7                      | -8      | -5                   | 2                  | -1      | 2                    |
| Venezuela                   |                   | -5      | -26                  | 4                       | 11      | 44                   | 0                  | -2      | 7                    |
| Eastern Europe <sup>2</sup> | -3                | 23      | 85                   | -6                      | -13     | -74                  | 9                  | 11      | 24                   |
| Czech Republic              | 3                 | 12      | 29                   | 0                       | -6      | -20                  |                    | 3       | 12                   |
| Hungary                     | 7                 | 5       | 23                   | -3                      | -3      | -26                  | 6                  | 1       | 2                    |
| Poland                      | -14               |         | 33                   | -3                      | -4      | -28                  | -0                 | 8       | 10                   |
| Algeria                     | -2                |         |                      | 4                       |         |                      | 1                  | -1      | 25                   |
| Israel                      | 2                 | 9       | -3                   | -4                      | -10     | -5                   | 0                  | 2       | 3                    |
| New Zealand                 | 6                 | 8       | 11                   | -4                      | -7      | -13                  | -1                 | -0      | 1                    |
| Russia                      |                   | -26     | -45                  |                         | 0       | 0                    |                    | -5      | 59                   |
| Saudi Arabia                | 57                | 12      | -59                  | -67                     | -5      | 65                   |                    | -1      | 8                    |
| South Africa                | -3                | 7       | 13                   | 8                       | -4      | -5                   | 0                  | -1      | 5                    |
| Turkey                      | 14                | 10      | 15                   | -10                     | -5      | -27                  | 0                  | 1       | 16                   |

<sup>1</sup> In billions of US dollars. <sup>2</sup> Sum of the countries shown. <sup>3</sup> Up to September 2004.

Sources: IMF.

Table A2

## Foreign reserves net of currency in circulation

|                | As a % of M1 |       | As a % of M2 |      | As a % of domestic credit to the private sector |       |
|----------------|--------------|-------|--------------|------|---|-------|
|                | 1990         | 2004  | 1990         | 2004 | 1990  | 2004  |
| Asia, large    | -1.9         | 99.7  | -3.5         | 11.2 | -4.3  | 16.8  |
| China          | -26.0        | 20.2  | -12.4        | 7.7  | -11.2   | 10.2  |
| India          | -47.5        | 40.4  | -16.7        | 11.4 | -28.2   | 22.2  |
| Korea          | 23.9         | 324.0 | 2.6          | 21.0 | 3.7   | 27.3  |
| Taiwan         | 41.8         | 14.2  | 12.6         | 4.5  | 18.7  | 7.3   |
| Asia, other    | 96.1         | 192.8 | 17.6         | 34.9 | 20.8  | 48.5  |
| Hong Kong SAR  |              | 213.5 | 7.1          | 18.7 | 9.0   | 38.2  |
| Indonesia      | 37.2         | 99.2  | 10.4         | 24.0 | 9.0   | 47.2  |
| Malaysia       | 62.3         | 167.7 | 18.9         | 38.5 | 19.1  | 41.3  |
| Philippines    | -4.6         | 140.3 | -1.2         | 27.8 | -2.1  | 50.7  |
| Singapore      | 271.4        | 386.8 | 55.8         | 78.9 | 74.2  | 87.2  |
| Thailand       | 114.2        | 149.1 | 14.6         | 21.3 | 15.8  | 26.1  |
| Latin America  | 116.7        | 116.9 | 42.3         | 40.2 | 61.1  | 68.6  |
| Argentina      | 60.5         | 54.4  | 23.4         | 20.5 | 17.3  | 60.5  |
| Brazil         | 34.7         | 104.2 | 11.2         | 25.0 | 8.9   | 23.7  |
| Chile          | 276.8        | 177.0 | 83.1         | 39.5 | 46.5  | 25.5  |
| Colombia       | 89.5         | 96.5  | 48.8         | 31.4 | 60.4  | 44.1  |
| Mexico         | 13.4         | 71.4  | 2.1          | 12.3 | 4.9   | 39.6  |
| Peru           | 91.5         | 154.2 | 49.2         | 53.7 | 147.7   | 77.9  |
| Venezuela      | 250.5        | 160.3 | 78.5         | 99.2 | 142.1   | 208.9 |
| Central Europe |              | 48.1  |              | 21.2 |   | 34.0  |
| Czech Republic |              | 44.4  |              | 25.1 |   | 52.4  |
| Hungary        | -13.4        | 38.7  |              | 14.4 | -7.1  | 14.8  |
| Poland         | 8.3          | 61.3  |              | 24.2 | 6.6   | 34.9  |
| Algeria        | -46.2        | 92.5  | -36.4        | 51.0 | -50.5   | 287.2 |
| Israel         | 144.1        | 213.4 | 13.6         | 19.3 | 16.6  | 20.7  |
| New Zealand    | 70.9         | 32.9  | 10.6         | 5.4  | 10.7  | 4.1   |
| Russia         |              | 62.4  |              | 32.4 |   | 42.7  |
| Saudi Arabia   | 164.2        | 93.7  | 89.2         | 50.6 | 256.4   | 80.9  |
| South Africa   | -1.8         | 11.1  | -0.7         | 5.8  | -0.6  | 4.2   |
| Turkey         | 42.7         | 165.6 | 13.8         | 24.4 | 21.1  | 54.4  |

Sources: IMF; national data.

Table A3  
**Central bank securities outstanding<sup>1</sup>**

|                             | 2000  | 2001  | 2002  | 2003  | 2004 <sup>2</sup> |
|-----------------------------|-------|-------|-------|-------|-------------------|
| Asia <sup>3</sup>           | 77.4  | 83.8  | 79.0  | 92.1  | 102.2             |
| Hong Kong SAR               | 50.4  | 49.5  | 47.7  | 41.1  | 43.2              |
| Indonesia                   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0               |
| Korea                       | 235.1 | 241.0 | 221.9 | 258.9 | 297.7             |
| Malaysia                    | 20.5  | 73.7  | 89.6  | 86.7  | 50.1              |
| Philippines                 | 21.1  | 26.1  | 23.4  | 20.6  | 24.3              |
| Thailand                    | 0.0   | 0.0   | 0.0   | 19.1  | 24.5              |
| Latin America <sup>3</sup>  | 78.8  | 93.0  | 38.0  | 29.9  | 26.0              |
| Brazil                      | 128.1 | 158.5 | 34.3  | 16.4  | 8.6               |
| Chile                       | 0.6   | 0.6   | 0.6   | 0.6   | 0.5               |
| Mexico                      | 60.6  | 61.7  | 62.4  | 47.6  | 49.9              |
| Peru                        | 6.0   | 7.4   | 6.0   | 16.5  | 24.0              |
| Venezuela                   | 0.0   | 0.0   | 14.5  | 70.7  | 52.5              |
| Central Europe <sup>3</sup> | 62.6  | 51.0  | 81.0  | 69.7  | 68.4              |
| Czech Republic              | 61.0  | 77.6  | 269.1 | 250.8 | 241.5             |
| Hungary                     | 30.9  | 33.4  | 2.0   | 1.9   | 1.9               |
| Poland                      | 73.8  | 46.3  | 33.2  | 20.8  | 22.3              |
| Others <sup>3</sup>         | 3.6   | 25.4  | 33.6  | 36.4  | 52.2              |
| Israel                      | 0.0   | 96.0  | 110.9 | 130.9 | 179.3             |
| South Africa                | 4.8   | 1.7   | 7.6   | 4.6   | 9.5               |

<sup>1</sup> As a percentage of reserve money; end of period. <sup>2</sup> Data pertains to various months as reported by the central banks up to November 2004. <sup>3</sup> Weighted average of the economies listed based on 2000 GDP and PPP exchange rates.

Sources: IMF; central banks.

Table A4

## Main instruments for sterilisation

|                       | Monetary instruments   |   | Fiscal policy |  |
|-----------------------|--|---|---------------|--|
|                       | Market   | Non-market  | Fiscal stance | Government cash balances   |
| <b>Hong Kong SAR</b>  | No sterilisation   | No sterilisation  | No            | Yes;<br>(operations via commercial banks)                            |
| <b>India</b>          | TBs and government securities, liquidity adjustment facility auctions, and since April 2004 monetary stabilisation scheme: occasionally govt surplus balance | Reserves ratio under extreme conditions                                     |               | Yes,<br>(during 2003-04)   |
| <b>Indonesia</b>      |  | Reserve requirements (not explicitly used for sterilisation)                |               |  |
| <b>Korea</b>          | Monetary Stabilisation Bonds   | No  | No            |  |
| <b>Malaysia</b>       | Mainly money market borrowing; CB's own securities   | Centralisation of government deposits; statutory reserves to a small extent | No            | Yes<br>(coordination between CB and banks on a daily basis)          |
| <b>Philippines</b>    | Repos, reverse repos and outright transactions in general  | Tiering structure of over night deposits with the CB                        | No            | Yes<br>(coordination with the government on an infrequent basis )    |
| <b>Thailand</b>       | Repos, FX swaps, CB securities   | No  | No            | Yes<br>(coordination with the government on an daily basis )         |
| <b>Brazil</b>         | Reverse repos (government bonds as collateral)   | No  | No            |  |
| <b>Chile</b>          | CB's own securities  | No  | No            | Yes<br>(monthly coordination between govt and the CB)                |
| <b>Colombia</b>       | Government bonds   | No  | No            | Yes<br>(coordination with the government)                            |
| <b>Mexico</b>         | CB's own securities (government bonds used in the past); long-term deposits with CB  | Yes;<br>special deposit facility (at market rates) irregularly used         | No            | No   |
| <b>Peru</b>           | CB's own securities  | No  | No            | No   |
| <b>Czech Republic</b> | Repos; CB bills used as collateral   | Reserve requirements (not specific to sterilisation)                        | No            | Yes<br>(generally taken into account for monetary policy operations) |

Table A4 (cont)

**Main instruments for sterilisation**

|                     | Monetary instruments   |                              | Fiscal policy |   |
|---------------------|--|------------------------------|---------------|---|
|                     | Market   | Non-market                   | Fiscal stance | Government cash balances  |
| <b>Hungary</b>      | Two-week and overnight deposit facilities  |                              |               | Yes<br>(cooperation at the strategic level)                               |
| <b>Poland</b>       | CB securities (14 days maturity); deposit facility   |                              |               | Yes<br>(very limited coordination with the government)                    |
| <b>Israel</b>       | One-year TBs ("Makam" government securities only issued for monetary policy purposes)      | Yes                          | No            | No  |
| <b>New Zealand</b>  | TBs, government bond sales; repo and reverse repo of government securities                 | No                           |               |   |
| <b>South Africa</b> | CB securities; government bonds (outright & repos)   | No; but currently considered | No            | Yes<br>(government cash flows managed to have a neutral liquidity impact) |
| <b>Turkey</b>       | Mainly reverse repos in government bonds; standing deposit facilities and deposit auctions | No                           |               | Yes<br>(but still limited coordination)                                   |

Source: Central bank responses to BIS questionnaire.



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