Foreign exchange market intervention in EMEs: implications for central banks

Ramon Moreno[1]

1. Introduction

The recovery of the global economy that followed the Lehman bankruptcy in September 2008 has been associated with renewed foreign currency inflows to emerging market economies (EMEs), reflecting a combination of capital inflows and current account surpluses.[2] The resulting exchange rate appreciation and the question of what do about it have raised concerns that were last heard prior to the bankruptcy of Lehman Brothers. Many emerging market central banks have responded to appreciation pressures by intervening in foreign exchange markets, thus expanding central bank foreign assets and balance sheets. An important concern is that large changes in central bank balance sheets induced by foreign asset growth will hinder the conduct of monetary policy.

To shed light on some of these issues, this paper will discuss recent trends in the balance sheets of central banks and the motives for accumulating foreign assets (Section 2). Section 3 discusses issues raised by the use of alternative approaches to the sterilisation of foreign exchange market interventions. Some implications for commercial banks are briefly discussed in Section 4. Section 5 concludes.

2. The balance sheets of central banks in emerging markets

2.1 Recent developments in central bank balance sheets

Table 1 shows a simplified central bank balance sheet to illustrate the implications of foreign asset accumulation. Assets comprise net foreign assets and domestic assets (including government securities).[3] Liabilities include currency in circulation and reserves of commercial banks (ie monetary liabilities); and government deposits, central bank securities and other liabilities (ie non-monetary liabilities). Appendix Tables A1 and A2 show selected balance sheet assets and liabilities for a set of emerging market central banks.

According to Table 1, if we take equity capital as given, the accumulation of foreign asset must be financed by either the sale of domestic assets or the issuance of domestic liabilities.

---

[2] Recent commentary suggests that capital flows in 2010 may have been higher. At this writing, the Institute for International Finance (2011) estimates that net private capital flows to a set of EMEs rose by 50% (which was more than anticipated) to more than $900 billion in 2010.

[3] We use foreign assets and foreign reserves interchangeably in our discussion, although the latter are the more liquid component of the former.

As noted in CGFS (2009), one simple measure of this type of financing is the excess of foreign currency reserves over currency in circulation.[4]

<div style="text-align: center;">

Table 1

Stylised central bank balance sheet

</div>

Assets	Liabilities and capital
Net foreign assets	Monetary liabilities
Domestic assets	• Currency in circulation
	• Reserves of commercial banks
	Non-monetary liabilities
	• Government deposits
	• Central bank securities
	• Others
	Equity capital

Until the late 1990s, this "financing gap" was either small or negative in many EMEs. In other words, foreign reserve assets and currency in circulation were of a similar order of magnitude. With economic growth and the central bank purchase of foreign reserves, the rising demand for cash has meant that liabilities issued by the central bank had to increase by less than the increase in foreign reserves.

<div style="text-align: center;">

Graph 1

Central bank assets[1]

As a percentage of GDP

</div>
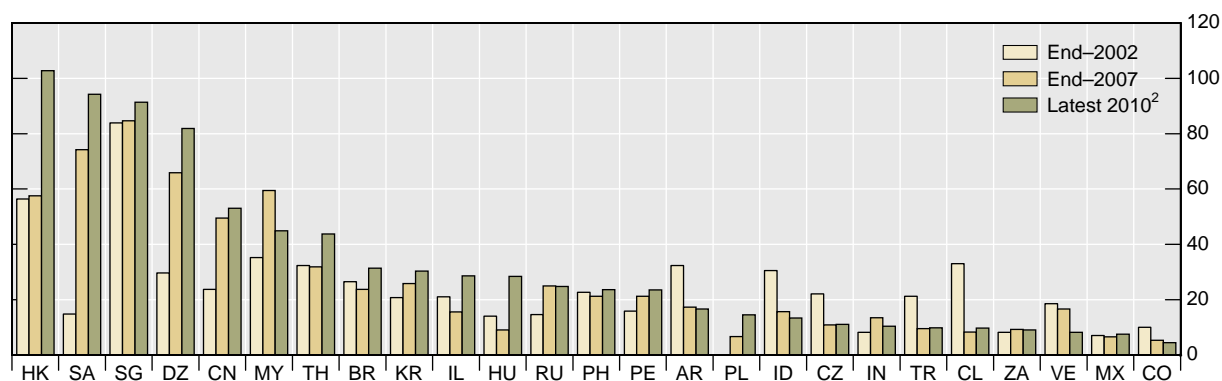
AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = Czech Republic; DZ = Algeria; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IL = Israel; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU = Russia; SA = Saudi Arabia; TH = Thailand; TR = Turkey; VE = Venezuela; ZA = South Africa.

[1] Net of currency in circulation. Countries are listed, in descending order, according to the latest information available for 2010.   [2] For the Philippines and Venezuela, November 2009.

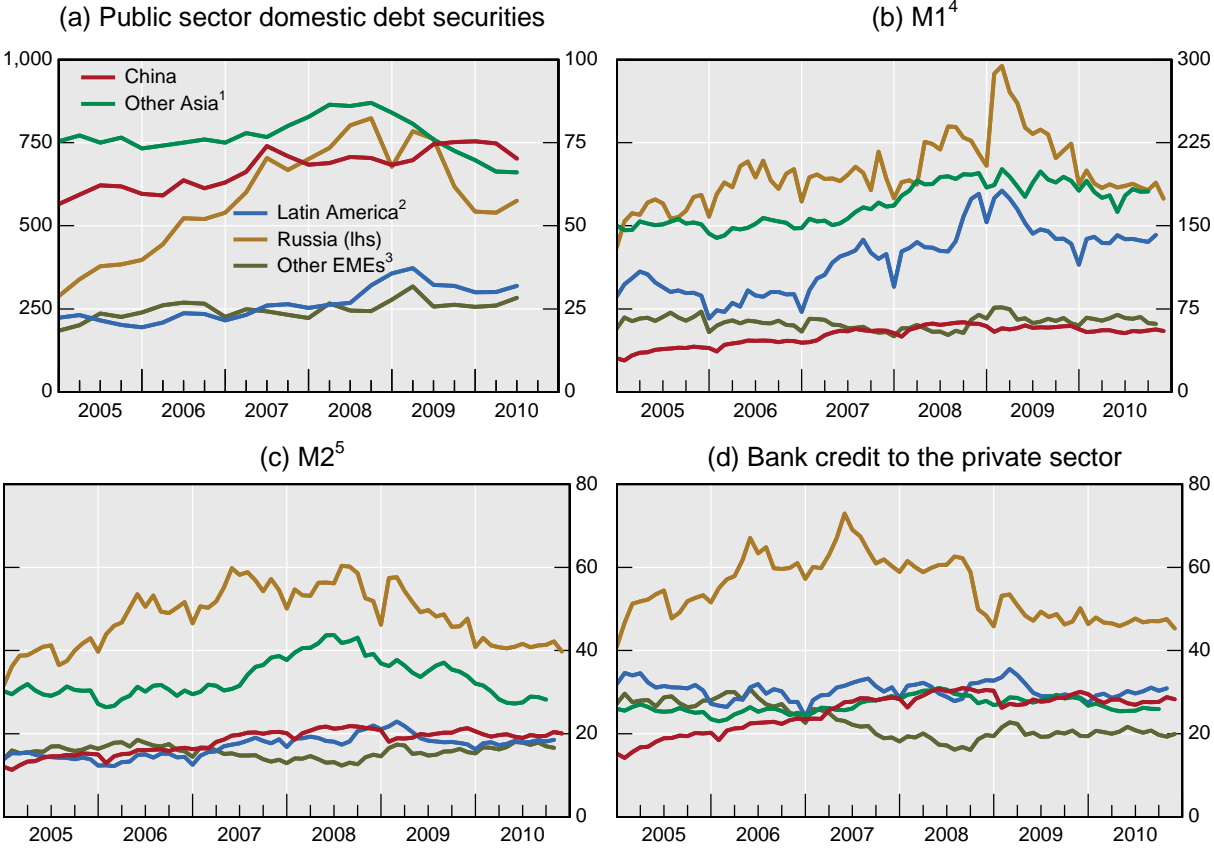Sources: IMF, *International Financial Statistics*, *World Economic Outlook*.

---

[4]   If currency in circulation is issued only when there is demand for it, foreign asset acquisition would have no inflationary consequence and could be netted out from assessments of the impact of reserve accumulation on the central bank balance sheet.

Since 2002, however, total central bank assets have grown significantly, in the case of Algeria, Hong Kong SAR and Saudi Arabia by 40–80% of GDP (Graph 1). As a result, central bank balance sheets in EMEs have expanded considerably: the median ratio of total central bank assets to GDP was around 24% in 2010.[5] Central banks with asset-to-GDP ratios that are well above the median include financial centres (Hong Kong SAR and Singapore); oil exporters (Algeria and Saudi Arabia); and some Asian economies (China, Malaysia and Thailand). Central banks with balance sheets well below the median are mostly inflation targeting regimes (Chile, Colombia, the Czech Republic, Mexico, Poland, Turkey and South Africa) but also Venezuela.

Graph 2

Foreign exchange reserves minus currency held by the public

As a percentage of

(a) Public sector domestic debt securities

(b) M1[4]

(c) M2[5]

(d) Bank credit to the private sector

[1] Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand.
[2] Argentina, Brazil, Chile, Colombia, Mexico and Peru.   [3] The Czech Republic, Hungary, Poland, Turkey and South Africa.   [4] M1, also called narrow money, comprises transferable deposits and currency outside deposit money banks.   [5] M2 is a broad measure of money which comprises, in addition to M1, time, savings, and foreign currency deposits of resident sectors other than central government.

Sources: IMF; Datastream; national data; BIS.

---

[5] There are many difficulties in using and interpreting central bank balance sheet data. To keep problems of comparability to a minimum, we follow Ulrich and Stella (2008) and rely on IMF IFS data. Nevertheless there appear to be visible differences between IMF and central bank-reported data in some countries.

In any case, central bank assets in emerging market economies are generally larger than in advanced economies, even after taking into account recent sharp increases in the size of central bank balance sheets in the United States, the euro area and the United Kingdom, among others. In addition, net foreign assets account for the bulk of total central bank assets in EMEs – the median share was 87% in 2010 (Appendix Table A1). The share of net foreign assets tends to be lower outside the Asian region, but it is still typically much larger in emerging markets than in advanced economies. Foreign reserves in emerging markets also tend to be large relative to the size of financial systems (Graph 2).

2.2   Motives for accumulation of foreign assets

Will accumulation of foreign assets by central banks continue? Continued recovery in advanced economies will have mixed effects on foreign currency flows to EMEs, which have driven accumulation of central banks' foreign assets in the past. On the one hand, it will tend to increase current account balances in EMEs (which fell during the 2008–09 crisis) by narrowing growth differentials that currently favour EMEs. On the other hand, it may reduce capital flows to EMEs by narrowing currently wide interest rate differentials. Much will also depend on the extent to which central banks intervene in foreign exchange markets. Three elements will play a role.

First, some central banks with floating exchange rates appear to have stepped up the pace of foreign exchange market intervention compared with the early 2000s (eg Brazil, Israel, the Philippines and Thailand), resulting in faster growth of foreign assets. Reasons could include greater concern about the possible impact of exchange rate fluctuations on inflation and concerns about competitiveness, particularly if there appears to be exchange rate overshooting or misalignment.[6] The increase in central bank foreign assets in Hong Kong, which has a fixed exchange rate regime, has also been large.

Second, since the Lehman Brothers bankruptcy in September 2008, some central banks appear to have concluded that their precautionary holdings of foreign reserves were too high, while others concluded the opposite.[7] Thus foreign reserve cover for short-term external debt (which was generally well above the rule-of-thumb threshold of 100%) has fallen in a number of economies where previously it was higher than average (eg Brazil, China, India and Malaysia; see Appendix Table A3), but has increased in other countries where it was lower than average (including Chile, Mexico and Peru). In some cases, foreign reserve cover has been increased in response to a perceived increase in risks to the global outlook.[8]

Third, the costs of foreign asset accumulation remain significant. Appendix Table A4 shows that sterilisation costs (reflecting the differential between the domestic interest cost of financing foreign asset positions and the interest rate earned on foreign assets) are quite

---

[6]   However, the evidence suggests that – possibly because of the adoption of inflation targeting – the pass-through from exchange rates to inflation has fallen. For a recent discussion of the exchange rate pass-through, see the paper by Vargas in this volume.

[7]   For a model showing factors that may cause actual foreign reserve holdings to diverge from the rule-of-thumb threshold of 100% (the so-called Guidotti-Greenspan criterion), see Jeanne and Rancière (2011). The factors they consider are the probability and the size of a sudden stop in capital inflows, consumer risk aversion, the opportunity cost of holding foreign reserves and (in an extended framework) the role of foreign reserves in reducing the probability of a sudden stop.

[8]   For example, Sidaoui et al discuss in their paper in this volume foreign reserve adequacy and Mexico's decision to increase foreign reserves. In addition, the Central Bank of Chile announced on 3 January 2011 a foreign currency purchase schedule to raise foreign reserves to "a level that is comparable with those in other economies similar to Chile", highlighting a number of risks in the global outlook (escalating financial tensions in Europe, persistent high unemployment rates in developed economies and sharper adjustments in some EMEs facing inflationary pressures). See http://www.bcentral.cl/eng/press/other/pdf/05012011a.pdf.

high in a number of countries, ie close to or exceeding 1% of GDP assuming full sterilisation. For countries with large foreign asset holdings, valuation losses that could be associated with a 10% appreciation could be even larger. High sterilisation costs may partly explain the tendency for foreign reserve cover to decline in some EMEs.[9]

These findings suggest that large foreign reserve holdings could significantly weaken central bank financial strength due to costs of financing (or sterilisation) and if exchange rate risks are realised. One measure of financial strength, the return on average assets (ROAA), was on a declining trend between 1998 and 2007, a period which included episodes of significant central bank foreign asset accumulation (Graph 3). While the return on average assets rose during the period of sharp exchange rate depreciation in EMEs in 2008, it has since once again turned downwards.

Graph 3

Return on average assets in emerging market central banks, 1995–2009[1]

In per cent
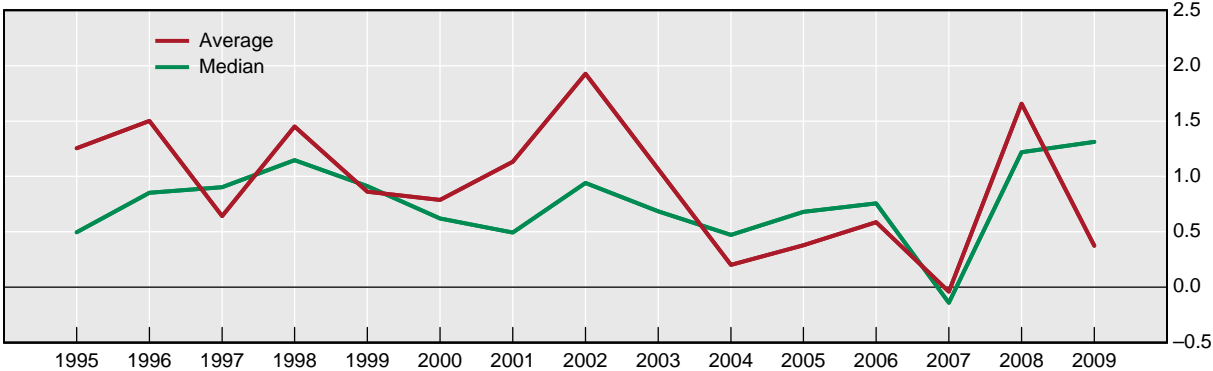
[1] Simple average and median of the return on average assets for the central banks of Argentina, Brazil, Chile, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand and Turkey.

Sources: Bankscope; BIS calculations.

Graph 4 reveals visible differences in performance of the return on average assets across emerging market regions. The return on average assets in Asia tends to be higher and less volatile than in other regions. This could partly reflect the impact of lower exchange rate volatility on central bank balance sheets. Episodes of exchange rate appreciation would tend to be associated with lower return on average assets, although this outcome will depend in part on accounting procedures.

There are two views on what lower returns on assets – or outright losses – imply for central bank credibility. On the one hand, losses mean that central banks are taking steps to drain liquidity created by foreign reserve accumulation, ie that central banks are serious about maintaining monetary control. On the other hand, losses raise questions about the sustainability of monetary policies and the central bank's ability to resist political pressures to

---

[9] In principle, carrying costs could be reduced by diversifying reserve assets, including buying more EM debt. In practice, the scope for such diversification is limited because of the small supply of higher-yielding investment grade assets: only $5 trillion in sovereign debt (of which $2 trillion in smaller advanced economies and $3 trillion in investment grade EMEs) is available, compared with $38 trillion in the major advanced economies. The supply of EME domestic debt securities is also relevant for sterilisation, as discussed below.

inflate. In line with this second view, an empirical study by Klüh and Stella (2008) finds that lower central bank financial strength is associated with higher inflation.

Graph 4

ROAA for central banks by region, 1999–2009

In per cent
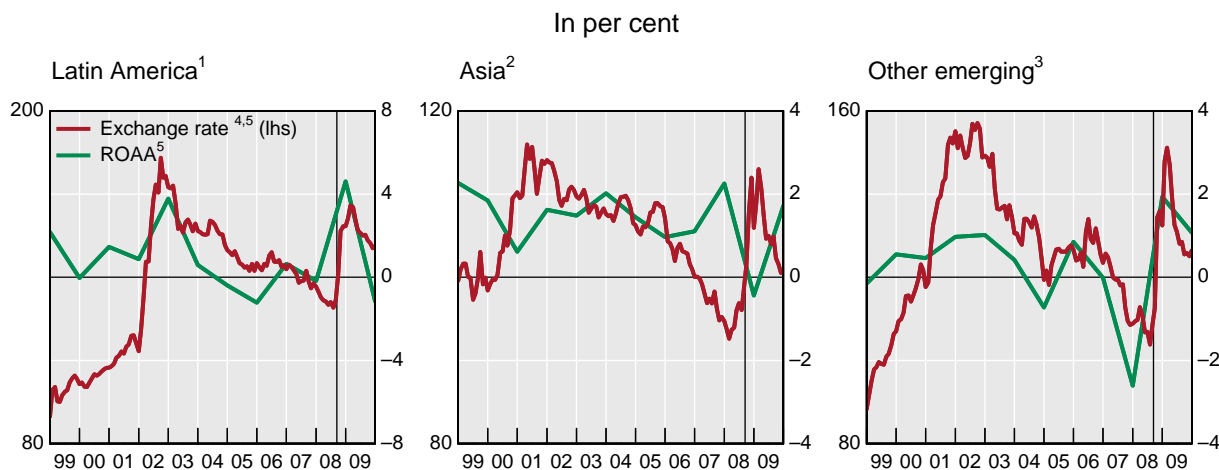
The vertical line marks the date of the Lehman Brothers bankruptcy on 15 September 2008.

[1] Argentina, Brazil, Chile, Colombia, Mexico and Peru. [2] Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. [3] The Czech Republic, Hungary, Israel, Poland, Russia, South Africa and Turkey. [4] National currency per US dollar indexes, 1999 = 100. [5] Simple average across region countries.

Sources: IMF; Bankscope; BIS calculations.

3.   Sterilisation and implications for central bank balance sheets[10]

How a central bank's intervention in the foreign exchange market to purchase foreign currency will affect its financial performance depends on how the intervention is financed. If reserve money is issued, the policy rate will tend to decline unless money demand increases. But money demand is unlikely to increase at a pace that matches a surge in foreign currency inflows. In order to maintain monetary control (ie to keep the policy rate close to its target level), a central bank can avoid or sterilise the expansionary effects of its foreign exchange market intervention via foreign currency operations that reduce the central bank's net foreign assets (issuance of foreign liabilities, implementing offsetting transactions in the foreign exchange market) or by implementing domestic operations (selling treasury securities on its portfolio, issuing central bank debt or accepting government deposits). These are market-based instruments for sterilisation. In a number of cases, central banks have also used non-market instruments, such as adjusting reserve requirements for commercial banks. The choice of sterilisation instruments – or how a central bank finances its acquisition of foreign assets – will have different implications for a central bank's balance sheet, the risks it assumes and the costs.

---

[10] For related discussions on central bank balance sheets, see CGFS (2009) and the contributions in this volume by Vargas; Rossini et al; and Sidaoui et al.

3.1 Foreign currency operations

Central banks can limit the impact of foreign asset accumulation on the domestic financial system by issuing foreign liabilities or implementing forward or swap transactions in the foreign exchange market.

Most emerging market central banks have large net foreign asset holdings (Graph 5), suggesting that they do not rely exclusively on foreign debt issuance to fund foreign asset acquisition. Net foreign assets tend to be largest in Asia (in Hong Kong SAR and Singapore, net foreign assets are close to 100% of GDP or higher), and lowest in Latin America, with many central banks converging to an average of just over 10% (30% in the case of Peru). Net foreign asset positions in EMEs are much larger than in Japan, the United States or the euro area.

Graph 5

Central bank net foreign assets

As a percentage of GDP, in per cent

Asia[1]

Latin America[1]

Other emerging markets
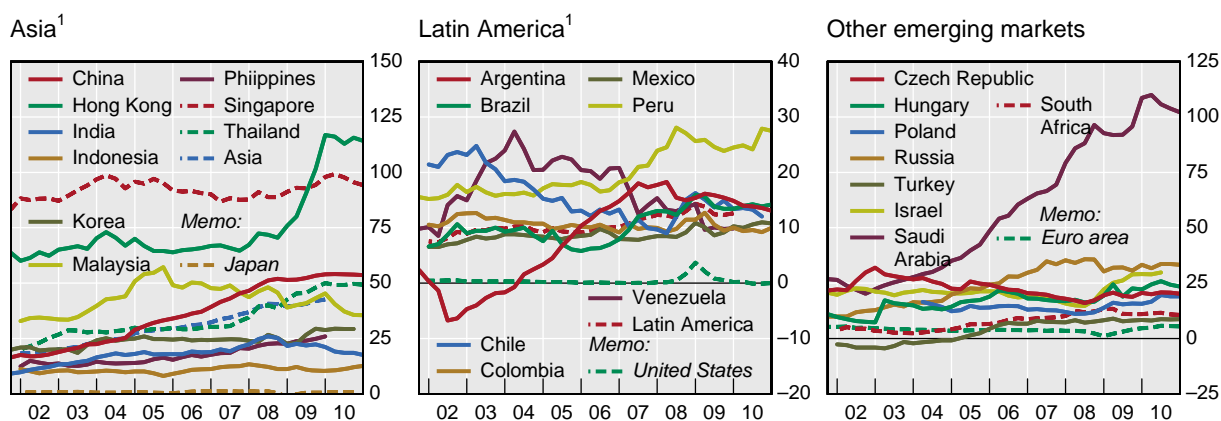
[1] Regional figures are weighted averages based on 2005 GDP and PPP exchange rates.

Source: IMF, *International Financial Statistics.*

As for forward or swap transactions in the foreign exchange swap market, some central banks buy foreign currency spot, then implement a foreign exchange swap in which they sell the foreign currency spot and purchase it forward. The resulting net long forward position has no visible impact on the balance sheet until closed, but it is often reported by central banks to the IMF under the Special Data Dissemination Standard (SDDS).[11] Appendix Graph A1 illustrates foreign exchange forward positions for a set of emerging market economies, as well as movements in their exchange rates. The increase in net positive foreign currency positions in a number of EMEs (eg in Southeast Asia) from around 2005 to 2008, when their exchange rates were appreciating, is consistent with an increase in spot purchases of foreign currency that were sterilised via swaps. However, in some countries the connection between forward positions and the exchange rate is much looser, indicating that foreign exchange swap or forward market transactions do not reflect sterilisation along the lines described.

---

[11] The SDDS was one outcome of efforts to improve transparency following the Asian crisis.

Instead, such positions may be maintained to hedge foreign currency exposures or influence liquidity in foreign exchange markets.[12]

Net foreign asset or net long forward positions can be used to make foreign currency resources available during periods of financial stress. However, these positions mean that a large proportion of foreign asset acquisition will typically require sterilisation via domestic operations, leading to the sterilisation costs cited earlier.

3.2   Domestic operations

Sterilisation via repo operations has been facilitated by the availability of government debt securities that can be presented as collateral.[13] While there are prohibitions (constitutional or legislative) on central bank financing of the government in many countries, notably in central and eastern Europe and Latin America, central bank purchases of government bonds in the secondary market have been allowed in many EMEs for some years now (Hawkins (2003, Table 6)). Furthermore, issuance of government debt securities in EMEs has risen; by June 2010, it had reached around $5 trillion for a set of larger EMEs, compared with slightly under $1 trillion in December 1999.

Remaining maturities of debt instruments have also lengthened (Appendix Table A5). In larger EMEs in Asia, remaining maturities rose from 5.3 years in 2000 to 7½ years in 2009. Maturities tend to be shorter in Latin America (although they nearly doubled to 4½ years over the same period), but have nevertheless lengthened in the past decade, notably in Mexico (from 1.4 to 6.4 years). The longest maturities of emerging market debt securities in 2010 were observed in India (10½ years), Peru (16 years) and South Africa (10.6 years).

Some central banks issue their own debt instruments. Maturities of central bank debt securities have also lengthened, eg Bank Indonesia introduced maturities of up to a year in 2010 and discouraged holdings of securities with shorter maturities. The People's Bank of China began to issue three-year securities in 2005. Longer maturities imply that sterilisation operations could have a more lasting impact on the excess liquidity of the banking system.

The use of debt securities for sterilisation purposes raises a number of issues.

First, while markets have deepened, the availability of sterilisation instruments is sometimes limited. In particular, Appendix Table A1 shows that, with the exception of Argentina, Brazil, India and Indonesia, central bank claims on government represent a small fraction of total assets. While central bank securities sometimes provide an alternative, many countries (eg Brazil, India and the Philippines) prohibit the central bank from issuing its own debt

---

[12] Some central banks also acquire foreign assets by making transactions outside the foreign exchange market (Moreno (2005), CGFS (2009)); this is sometimes known as "direct intervention". This approach insulates the domestic financial system in some cases but not in others. For example, in Chile foreign assets accumulated by the state-owned copper company appear to be held in accounts abroad that are managed by the central bank and that do not enter the domestic banking system. If government deposits arising from copper exports are matched by central bank foreign assets, accumulation of the latter would have no impact on domestic financial intermediation. By contrast, in Mexico the central bank directly purchases foreign exchange from the state-owned oil company and the federal government in exchange for pesos (see Sidaoui et al in this volume). Since these entities acquire pesos in exchange for the foreign assets deposited in the central bank, the result is an increase in the commercial banks' balance sheets that needs to be sterilised.

[13] Government deposits are also an important source of liquidity drain from the financial system. They appear to be economically meaningful in most EMEs (Appendix Table A2) but have been particularly large – ranging from 13 to 45% of GDP – in Algeria, Hong Kong SAR, Israel, Russia, Saudi Arabia and Singapore. Government deposits rose during the 2000s in most EMEs. A particularly interesting case is that of India, which set up an arrangement (the Market Stabilisation Scheme) under which the Reserve Bank of India was empowered to "to issue government Treasury bills and medium-duration dated securities for the purpose of liquidity absorption" (Mohan (2008, p 248)).

securities.[14] One reason is that such securities could erode liquidity in the government debt market, by offering a competing "safe" instrument. Another consideration is that such an instrument, like other domestic operations, can mask the fiscal impact of sterilised intervention. This could result in significant losses to the central bank and, by extension, to the government.

Second, sterilisation can reduce the central bank's net creditor position vis-à-vis the market, which can in turn weaken the effectiveness of monetary control.[15] For example, when the central bank in Colombia becomes a net debtor to the market, excess liquidity is absorbed through a central bank facility with an interest rate 1 percentage point lower than the policy rate, implying a de facto change in monetary policy. There is also evidence that the pass-through from the policy rate to certain bank deposit and lending rates declines when the central bank is in a net debtor position (Vargas et al (2010), Vargas in this volume).[16]

Third, foreign holdings of domestic debt securities can affect the cost of financing and its volatility. Recent estimates by Peires (2010) indicate varying degrees of foreign participation in bond markets in EMEs: they are comparatively high in central Europe (25–35% in 2008), and lower in other EMEs (15% in Indonesia, 10% or lower in Brazil, Korea, Malaysia, Mexico, Thailand and Turkey). Using panel data analysis, Peires finds that foreign participation in the domestic government bond market significantly lowers long-term government yields and does not necessarily imply increased volatility (and might lower it in some cases).[17] While lower financing costs are a considerable benefit of more open financial markets, the flip side is that monetary authorities might not want to accept lower interest rates if the economy is close to capacity during periods of surging capital inflows.

Furthermore, during periods of exchange rate appreciation, foreign investors may take one-sided bets that generate exchange rate volatility. This effect is amplified if foreign investors hold a large share of domestic securities, and that share increases during episodes of appreciation. This occurred in Peru, where the central bank adopted a number of measures to dampen capital inflows in response to sterilised intervention by making it more difficult or costly for foreign investors to acquire central bank securities.[18] In addition, during periods of financial stress foreign residents might seek to wind down their positions in domestic bond markets very quickly. For example, this was the experience of Mexico in the aftermath of the Lehman Brothers bankruptcy (Sidaoui et al (2010), Jara et al (2009)).

---

[14] Vargas notes in his contribution to this volume that Colombia passed a law authorising the central bank to issue its own debt securities but none had been issued yet.

[15] Kamil (2008) argues that the risk that the central bank in Colombia might become a net debtor undermined the credibility of foreign exchange market intervention to dampen exchange rate appreciation, prompting investors to take positions that rendered such intervention ineffective.

[16] The paper by Vargas in this volume notes that remunerated, non-reserve deposits in Colombia are used when the central bank becomes a net debtor of the financial system, as the effects of sterilisation on the monetary policy stance are neutral. However, these deposits pose complications, including: the possibly of attracting capital inflows (if maturities are short); reduced incentives for banks to lend on the interbank market; and weaker control over liquidity (if maturities are longer).

[17] Peires (2010, Table 4) finds that foreign investor participation increases government bond yield volatility in Korea; lowers it in Malaysia, Mexico and Turkey; and is not significant in other countries (Brazil, the Czech Republic, Hungary, Indonesia, Poland and Thailand).

[18] The paper by Rossini et al in this volume indicates that the central bank: (i) imposed a 4% fee on purchases or sales of central bank paper involving non-residents, in order to limit resale to them; (ii) increased to 120% the reserve requirement on local currency deposits for non-residents; and (iii) used certificates of term deposits as sterilisation instruments so that non-residents could not access central bank paper indirectly, through the resale of other local currency instruments to non-residents.

3.3   Reserve requirements

Central banks have also sterilised by adjusting reserve requirements on bank deposits. Graph 6 shows that during the period of strong capital inflows (between 2006 and mid-2008), reserve requirements were raised quite frequently in China and India (over certain periods, more frequently than policy rates), and were lowered following the Lehman bankruptcy, when capital flows to EMEs reversed. Reserve requirements were later raised again in a number of countries.

Graph 6

Reserve requirements and reference rates[1]

In per cent
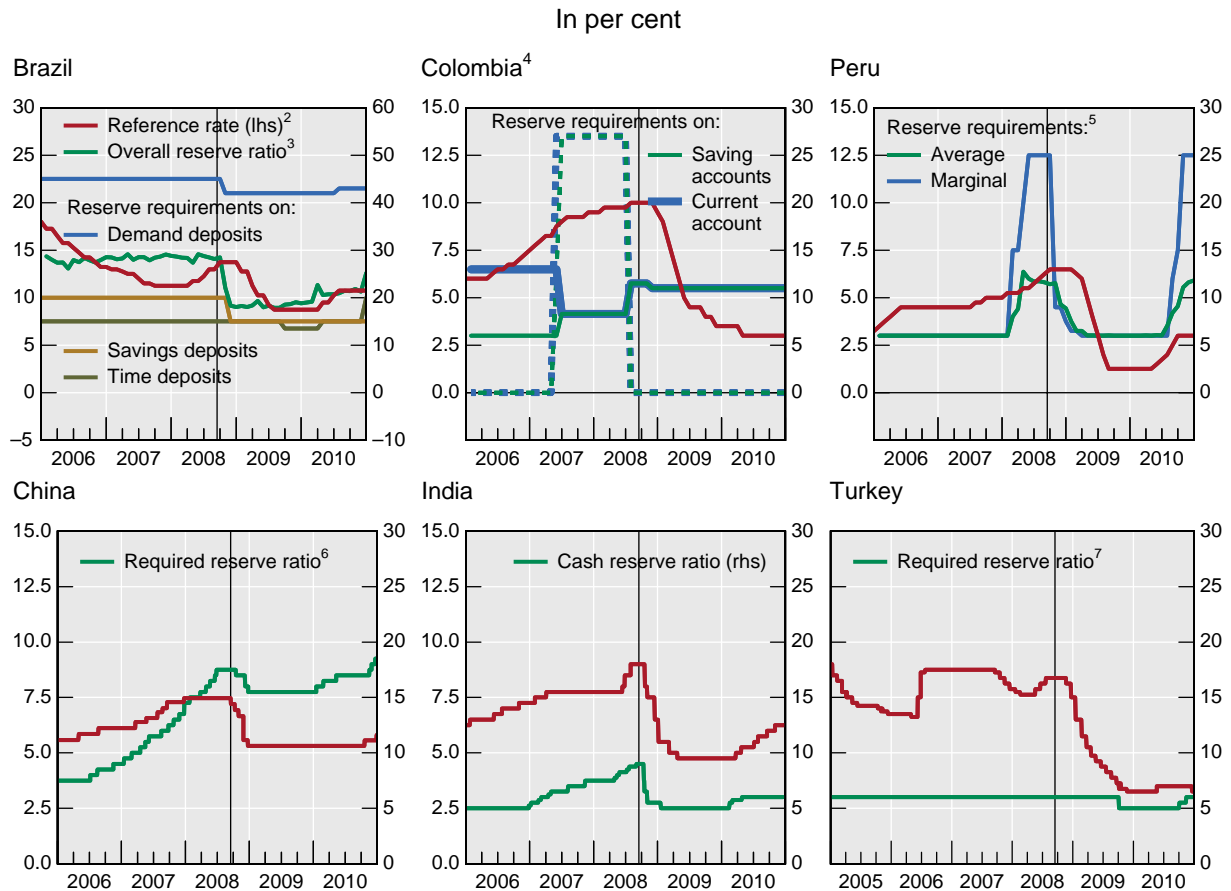
The vertical line marks the date of the Lehman Brothers bankruptcy on 15 September, 2008.

[1] On right-hand side scale unless otherwise indicated.   [2] For Brazil, SELIC target rate; for Colombia, minimum expansion rate; for Peru, reference rate; for China, 1-year lending rate; for India, repo rate; for Turkey, one-week repo lending rate (overnight borrowing rate prior to May 2010).   [3] Effective reserve requirement ratio. [4] Marginal reserve requirements in dashed lines.   [5] For domestic currency.   [6] For major banks.   [7] For domestic currency demand and notice deposits, and domestic currency private current accounts.

Sources: Bloomberg; CEIC; Datastream; national data.

The main disadvantage of reserve requirements is that, if bank reserves are remunerated at less than a market rate of interest rate, they impose a distortionary tax on banks that may encourage financial disintermediation. Bearing this in mind, the following explanations may be offered for why a number of authorities still resort to reserve requirements: (i) they may be

easier to implement; (ii) they do not tend to attract capital inflows as much as higher interest rates; (iii) they can serve as an alternative policy instrument; and (iv) they could provide some financial stability benefits.[19]

Ease of implementation. Reserve requirements potentially avoid many of the problems of sterilisation via domestic operations cited earlier (sterilisation costs to the central bank if not fully remunerated, lack of sterilisation instruments, concerns about the central bank's net creditor position). Furthermore, reserve requirements are an instrument available to most central banks; indeed, they may be the only instrument that can supplement the policy rate when banking supervision and regulation is in a different institution. At the same time, adjustments to liquidity involve the banking system's own balance sheet; so the central bank does not directly incur any costs or risks.

Smaller effect on capital inflows. A dilemma confronting policymakers during periods of large capital inflows is that raising interest rates can attract more capital inflows. To avoid this dilemma, some central banks have increased domestic reserve requirements instead. The reason is that banks can be expected to compensate for the impact of higher reserve requirements by adjusting deposit or lending rates in a way that increases their net interest margins. An increase in reserve requirements can tighten domestic financing conditions without attracting more capital inflows if banks do not raise the deposit rate but rather lending rates. Recent experience and some central bank research suggest that banks may indeed pass on the costs of an increase in reserve requirements to depositors (by lowering deposit rates; see Montoro and Moreno (2011) and Vargas et al (2010)), in order to increase the margin between lending and deposit rates.

Alternative policy instrument. Changes in reserve requirements may be preferred for sterilisation purposes when transmission via the policy rate is weak, eg when financial markets are underdeveloped; during episodes of financial stress (Quizpe and Rossini (2010)); or when policy rates are close to zero. They may also make it easier to resolve conflicting objectives. For instance, in the case of a sudden negative external shock that leads to a reversal in capital inflows and the sale of foreign reserves, monetary authorities may prefer to sterilise by lowering reserve requirements in order to ease monetary conditions. In Latin America and central and eastern Europe, reserve requirements fell shortly after the Lehman Brothers bankruptcy, which was consistent with sterilising the contractionary effects of foreign currency liquidity provision in foreign exchange markets experiencing severe stress. Policy rates were lowered in Latin America starting in December 2008, after much of the turmoil had passed (Graph 6). This may be useful if changes in the policy rate are seen as signalling policymakers' commitment to inflation stability, while changes in reserve requirements are seen as addressing financial stability concerns. An important question is whether it is best to use interest rates and reserve requirements so that they reinforce each other (eg to raise reserve requirements when the policy rate is also being raised) or whether these two instruments could be used in opposing directions, assigned to different targets. This last type of policy assignment has been implemented in Turkey:[20] In

---

[19] For a related discussion on the use of reserve requirements, see Montoro and Moreno (2011).

[20] On 11 November 2010, the Monetary Policy Committee (MPC) of the Central Bank of the Republic of Turkey (CBRT) announced a large reduction in the overnight borrowing rate (from 5.75% to 1.75%) as well as in the late liquidity borrowing rate (from 1.75% to 0%), citing low inflation. The interest rate corridor was also widened, to encourage longer-term investments. See Press Release on Summary of the Monetary Policy Committee Meeting, no 2010-39, 29 November 2010. This was done in a setting in which reserve requirements had been rising. On 12 November, the CBRT announced a 0.5 percentage point increase in the Turkish lira required reserve ratio to 6% with immediate effect. This followed an earlier increase of 0.5 percentage points on 1 October 2010. (The FX required reserve was also increased.) See Press Release on Required Reserves, no. 2010-38, 12 November 2010. In 2011, authorities relied more heavily on reserve requirements, raising them to a peak of 16% for demand deposits in April while keeping interest rates stable (2011 is not shown in graph).

late 2010, interest rates were lowered sharply, which could dampen exchange rate appreciation in the face of a current account deficit and in a setting of low inflation. At the same time, reserve requirements were increased, which could restrain credit growth (see the paper by Binici and Yörükoğlu in this volume).

Financial stability benefits. Reserve requirements can act countercyclically, containing credit growth (and, by extension, asset price increases) and building a cushion of reserves in the upswing of the business cycle; and enabling bank credit to grow during periods of stress.[21] Similar countercyclical effects can be achieved by sterilising via open market operations. Both types of sterilisation instruments also reduce banking sector currency mismatches that could arise from central bank sales of foreign reserves.

However, these instruments may have different implications for other types of risks. For example, reserve requirements may imply lower market risk but greater exposure to rollover risks. In particular, reserve requirements lead commercial banks to deposit a certain amount of their assets at the central bank (with no flexibility on how much is allocated), while domestic monetary operations prompt them to acquire government securities. In the latter case, banks are exposed to market risks that they may not be well equipped to handle (in EMEs, most bank risk exposure is traditionally in the form of credit risk). Furthermore, risk weights on government debt can be significant under Basel II (BCBS (2006, paragraph 53), ranging from zero (for ratings AAA to AA–) to 150% (ratings below B–). As recent experience shows, sudden changes in the market value of debt and rating downgrades can have a large impact on bank balance sheets.

As for rollover risks, the costs that reserve requirements impose on domestic banks may encourage banks to resort to short-term wholesale (domestic or foreign) financing, rather than rely on more stable deposits (typically their most important source of funds). The extent to which this creates problems will depend on the availability of such financing.

4. Implications for domestic money and credit

How has foreign asset accumulation affected domestic money and credit in EMEs? More systematic analysis is needed to answer this question, but an impression can be gained by examining the relationship between growth in net foreign assets of the central bank and, respectively, reserve money, M2 and credit to the private sector. A positive association could imply that sterilisation is incomplete, and the resulting increase in money and credit could pose macroeconomic and financial stability concerns.

Graph 7 illustrates this relationship during two recent periods of capital inflows, the first in the 2000s prior to the Lehman Brothers bankruptcy, and the second during the most recent period of recovery of capital inflows. As can be seen, in spite of the complete absence of control variables (and bearing in mind the presence of outliers), a positive relationship between net foreign asset growth and indicators of money and credit growth is apparent in a cross-section of countries prior to the Lehman bankruptcy. However, this relationship has broken down in the most recent period. This could reflect more effective sterilisation. Alternatively, it could mean that, although foreign assets have grown rapidly in some countries, weak growth in demand for money and credit has dampened the extent to which this is reflected in faster money growth.

---

[21] At least one central bank – Brazil – has also used reserve requirements in order to target certain vulnerable sectors during episodes of financial stress (Mesquita and Toros (2010)).

Graph 7

Growth in net foreign assets minus currency in circulation, versus growth in various monetary and credit aggregates[1]

Reserve money minus currency in circulation[2]

M2 minus currency in circulation[2]

Credit to the private sector minus currency in circulation[2]

Reserve money minus currency in circulation[3]

M2 minus currency in circulation[3]

Credit to the private sector minus currency in circulation[3]

$y = 4.86 + 0.384x$
Adjusted $R^2 = 0.4229$

$y = 10.36 + 0.214x$
Adjusted $R^2 = 0.2356$

$y = 14.77 + 0.206x$
Adjusted $R^2 = 0.0779$

$y = 19.25 + 0.064x$
Adjusted $R^2 = -0.0446$

$y = 9.35 + 0.005x$
Adjusted $R^2 = -0.0433$

$y = 8.57 + 0.059x$
Adjusted $R^2 = -0.0309$

[1] Horizontal axis: monetary authorities' net foreign assets minus currency in circulation. Vertical axis: reserve money minus currency in circulation, M2 minus currency in circulation, and credit to the private sector minus currency in circulation, respectively. The dots represent Algeria, Argentina, Brazil, Chile, China, Colombia, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, Singapore, South Africa, Thailand, Turkey and Venezuela. [2] Annualised changes between December 2002 and June 2008, in per cent. [3] Annualised changes between March 2009 and the latest available data, in per cent.

Sources: IMF, *International Financial Statistics*; Datastream.

5.   Conclusions

In the past decade, foreign asset growth has led to significant growth in central bank assets in EMEs. As a result, emerging market central bank assets are large – much larger than in advanced economy central banks, even after quantitative easing or large-scale asset purchases by the latter. Large foreign asset holdings of emerging market central banks appear to have been associated with significant costs for central banks, reflecting sterilisation costs and possible losses from domestic currency appreciation. In line with this, the return on average assets in a sample of emerging market economies has broadly declined during the period of strong capital inflows. There also appear to be macroeconomic effects: until September 2008, growth in net foreign assets was positively associated with growth in reserve money, M2, and credit (all net of currency in circulation). However, this relationship has broken down more recently.

Emerging market authorities have tried to sterilise or limit the impact of foreign asset accumulation on the domestic financial system through foreign currency operations (eg by issuing foreign liabilities). However, this has not fully offset gross foreign asset growth – certainly not in comparison with advanced economies – so that net foreign assets tend to be large. Much of the sterilisation by central banks is thus done via domestic operations – specifically, sales of treasury or central bank securities. Apart from costs, domestic operations raise a number of concerns. First, central bank claims on government are often small relative to the size of net foreign assets to be sterilised. While issuing central bank securities is a possible alternative, this is not always allowed because it may interfere with the smooth functioning of the market for government debt. Second, as a result of sterilisation, the central bank could become a net debtor in the domestic market, impairing its ability to regulate liquidity and conduct monetary policy. And third, while debt markets in EMEs have deepened and maturities of local currency debt securities have lengthened, greater participation by foreign investors can complicate sterilisation efforts.

Some authorities have used reserve requirements on commercial banks as an alternative sterilisation tool. Although reserve requirements impose significant costs on banks and could encourage financial disintermediation, they have some advantages over interest rates in terms of ease of implementation, impact on capital inflows, effectiveness and possible financial stability benefits.

Appendix

Table A1

Composition of central bank assets

As a percentage of total assets

	Net foreign assets		Claims on government	
	2002	**Latest**	**2002**	**Latest**
Emerging Asia				
China	49.7	84.9	6.2	6.2
Hong Kong SAR	99.8	100.0	…	…
India	71.3	79.1	25.4	18.8
Indonesia	29.4	71.6	46.9	24.0
Korea	85.6	87.3	3.0	5.4
Malaysia	79.4	70.3	0.4	0.6
Philippines	46.4	78.8	18.0	11.2
Singapore	95.2	96.0	3.9	2.5
Thailand	62.9	92.3	4.6	5.4
Latin America				
Argentina	−12.4	56.4	48.8	39.3
Brazil	9.5	38.0	64.4	54.8
Chile	62.7	82.6	29.6	6.4
Colombia	83.9	88.1	6.4	2.2
Mexico	71.3	89.7	…	…
Peru	87.8	96.0	0.9	…
Venezuela	80.5	85.1	8.3	3.1
CEE				
Czech Republic	93.0	95.9	1.4	…
Hungary	34.2	64.1	32.8	2.5
Poland	…	91.2	…	…
Russia	57.7	91.1	23.0	2.2
Turkey	−17.3	66.4	37.7	6.6
Other EMEs				
Algeria	86.3	98.5	6.6	0.1
Israel	88.4	87.3	8.6	7.5
South Africa	30.0	82.1	40.4	3.2

Source: IMF, *International Financial Statistics.*

Table A2

Share of central bank liabilities in total assets, in per cent

	Reserve money other than currency		Claims by non-residents		Bonds and securities		Government deposits		Capital account and other items (net)	
	2002	Latest	2002	Latest	2002	Latest	2002	Latest	2002	Latest
Asia										
China	60.8	52.0	1.0	0.6	3.2	16.8	6.7	13.3	−9.4	−0.0
Hong Kong SAR	16.0	40.4	0.2	0.0	…	…	36.2	27.3	34.0	21.8
India	17.7	22.3	1.0	1.7	…	…	0.0	2.3	25.5	19.6
Indonesia	12.5	41.4	15.5	2.8	…	5.4	17.6	7.9	27.6	6.5
Korea	10.7	9.8	5.9	5.5	61.8	44.7	6.6	1.3	3.3	29.5
Malaysia	9.5	1.2	1.6	13.9	…	…	4.6	6.1	20.1	5.8
Philippines	8.4	18.8	28.0	3.6	…	…	6.7	6.0	20.5	17.5
Singapore	5.1	6.0	0.9	1.5	…	…	63.6	43.1	22.1	42.1
Thailand	2.5	1.6	10.0	2.1	4.8	22.3	2.9	7.3	47.3	5.7
Latin America										
Argentina	11.7	26.2	42.4	3.7	2.7	25.1	0.1	3.5	29.1	13.5
Brazil	33.0	23.7	20.7	2.4	…	…	20.2	29.2	−4.4	2.1
Chile	36.5	64.3	1.7	4.6	45.9	18.5	2.9	1.9	2.4	−19.3
Colombia	4.7	13.5	2.7	5.3	…	…	0.8	5.7	58.0	13.2
Mexico	…	…	0.8	3.5	17.6	0.1	13.9	41.1	−2.7	−4.6
Peru	55.9	29.3	10.8	4.0	5.4	23.1	6.5	22.2	5.9	3.4
Venezuela	40.8	113.6	4.1	11.8	2.0	11.1	3.9	10.4	49.0	−49.2
CEE										
Czech Republic	4.7	6.5	0.6	3.4	…	…	10.7	11.6	−4.3	−14.7
Hungary	9.9	3.2	32.4	33.0	3.8	8.4	5.3	11.7	−3.7	−13.6
Poland	…	6.7	…	8.5	…	…	…	9.5	…	13.1
Russia	17.5	11.1	9.7	1.7	…	…	14.9	37.0	22.8	18.1
Turkey	17.1	35.6	76.1	19.1	…	…	7.3	9.8	−21.2	4.0
Other EMEs										
Algeria	8.8	3.1	7.0	1.5	…	…	22.2	41.0	10.9	15.5
Israel	41.2	40.0	0.6	5.2	…	…	40.5	49.1	5.5	−7.7
Saudi Arabia	12.2	5.0	…	…	…	…	32.8	60.8	21.7	28.3
South Africa	11.8	16.4	18.8	6.8	…	…	2.4	37.0	−2.6	2.2

Source: IMF, *International Financial Statistics*.

Table A3

Foreign reserve adequacy[1]

| | Outstanding year-end position | | | | | As a percentage of | | | | | | | |
| | In billions of US dollars | | | | % of GDP | Short-term external debt[2] | | | | M2 | | | |
	02	07	08	10	10	02	07	08	10	02	07	08	10
Asia[3]	945	2,907	3,318	4,672	55	524	449	586	433	30	35	35	36
China	286	1,528	1,946	2,847	50	1,369	1,249	1,868	1,092	13	28	28	26
Hong Kong SAR	113	147	178	261	116	197	144	189	190	25	19	22	28
India	67	267	247	263	19	983	340	338	227	19	28	27	19
Indonesia	31	55	49	86	13	228	185	174	192	31	31	30	33
Korea	121	262	200	287	29	271	176	172	171	17	19	19	19
Malaysia	32	101	91	102	47	331	447	402	365	25	40	35	29
Philippines	13	30	33	53	28	174	227	406	349	38	39	43	55
Singapore	82	163	174	226	104	141	127	150	153	76	77	75	69
Thailand	38	85	108	166	53	387	867	998	1,058	25	31	38	42
Latin America	140	397	440	547	13	127	238	362	270	57	47	49	...
Argentina	10	44	44	46	13	57	200	279	399	42	51	49	41
Brazil	37	179	193	281	14	124	292	364	253	20	20	24	19
Chile	15	17	23	27	14	140	86	113	123	47	18	28	23
Colombia	10	20	23	26	9	207	201	390	325	39	26	28	23
Mexico	50	86	94	112	11	107	254	240	314	15	15	18	16
Peru	9	27	30	44	29	136	284	248	312	181	165	157	144
Venezuela	8	24	33	11	4	119	347	901	166	54	33	36	...
CEE[4, 5]	165	753	703	776	20	264	153	144	188	...	74	84	62
Czech Republic	24	35	37	42	22	437	200	236	372	44	25	27	27
Hungary	10	24	34	42	32	110	88	99	123	29	29	43	52
Poland	30	66	62	94	21	218	245	178	257	36	29	28	37
Russia	44	467	413	449	31	275	493	490	691	66	86	86	75
Turkey	27	73	70	77	11	143	124	119	132	41	23	24	19
Other	71	359	510	541	49	339	605	993	670	35	72	89	84
Israel	24	28	42	67	33	523	587	556	485	47	34	44	56
Saudi Arabia[5]	42	301	438	436	102	433	1,058	2,215	1,270	51	169	207	182
South Africa	6	29	30	38	11	62	170	207	254	7	12	16	13

[1] Regional aggregates for the outstanding year-end position of foreign exchange reserves are the sum of the economies listed, simple averages otherwise.   [2] Short-term external debt defined as short-term liabilities to BIS reporting banks (consolidated cross-border claims of all BIS reporting banks on countries outside the reporting area with a maturity up to and including one year, plus international debt securities outstanding with a maturity of up to one year).   [3] Countries shown plus Chinese Taipei.   [4] Central and eastern Europe: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia and Turkey.   [5] For Saudi Arabia, excluding investment in foreign securities.

Sources: IMF; Thompson Reuters; national data.

Table A4

Estimates of sterilisation costs and valuation losses from domestic currency appreciation[1]

	FX reserves (USD billions)		Interest differential[2]		Sterilisation cost (100% sterilised)[3]		Valuation loss for a 10% appreciation of domestic currency (%)[4]	
	Jun 08	Sep 10	Jun 08	Sep 10	Jun 08	Sep 10	Jun 08	Sep 10
Asia								
China	1,809	2,648	0.8	2.6	0.4	1.4	4.7	5.2
Hong Kong SAR	152	256	−1.3	−0.1	−1.0	−0.1	7.3	12.2
India	302	265	5.2	6.0	1.4	1.2	2.7	2.1
Indonesia	57	80	5.6	6.1	0.7	0.8	1.3	1.3
Korea	258	285	2.1	2.1	0.6	0.7	2.7	3.1
Malaysia	125	97	0.5	2.5	0.3	1.1	6.3	4.4
Philippines	32	45	3.0	3.9	0.6	1.0	2.1	2.6
Singapore	177	215	−2.1	0.0	−1.9	0.0	9.1	10.8
Thailand	103	157	0.3	1.4	0.1	0.8	4.0	5.4
Latin America								
Argentina	45	46	10.7	12.1	1.8	1.9	1.7	1.6
Brazil	200	268	9.1	9.4	1.1	1.4	1.2	1.5
Chile	20	26	−2.6	−0.1	−0.3	0.0	1.2	1.4
Colombia	22	25	3.0	1.3	0.3	0.1	0.9	0.9
Mexico	93	108	4.9	4.6	0.4	0.5	0.9	1.2
Peru	35	40	2.4	2.6	0.7	0.8	3.0	2.9
Venezuela	23	10	14.2	14.2	1.4	0.9	1.0	0.6
CEE								
Czech Republic	38	44	0.8	0.5	0.1	0.1	1.7	2.3
Hungary	27	44	5.5	4.9	0.9	1.8	1.7	3.7
Poland	83	99	3.0	3.2	0.5	0.7	1.5	2.2
Russia	555	458	2.3	3.2	0.9	1.1	3.9	3.6
Turkey	76	76	14.6	7.1	1.6	0.8	1.1	1.2
Other EMEs								
Algeria	133	155	0.3	3.4	0.2	3.9	8.9	11.6
Israel	31	65	0.9	1.4	0.1	0.5	1.5	3.1
Saudi Arabia	377	413	−0.1	0.0	−0.1	0.0	9.8	11.0
South Africa	31	36	9.1	5.7	1.1	0.6	1.2	1.1

[1] Assumes that FX reserves are invested in one-year sector bonds and that domestic liabilities have one-month average maturity. [2] Domestic borrowing cost (mostly one-month interbank rate) minus the investment rate (basket of one-year government bond rates (65% USD, 25% EUR, 5% JPY and 5% GBP)). [3] The financial cost for the FX reserves (FX reserves multiplied by the interest rate differential) as a percentage of the nominal GDP per annum. [4] 10% valuation loss on the FX reserves as a percentage of the nominal GDP per annum.

Sources: IMF; CEIC; Datastream; Bloomberg; JPMorgan Chase; national data; BIS calculations.

Table A5

Maturity of domestic central government debt outstanding[1]

Average original and remaining maturity in years[2]

	2000		2007		2009	
	Original	Remaining maturity	Original	Remaining maturity	Original	Remaining maturity
Asia						
China	...	...	...	...	...	...
Hong Kong SAR	5.6	3.2	6.6	3.6	6.6	3.4
India	13.0	[7.1]	14.7	10.0	13.8	10.5
Korea	4.0	2.4	7.0	4.4	7.6	4.6
Indonesia	5.6	6.0	13.3	12.7	6.7	6.1
Malaysia	...	5.0	10.0	5.4	9.2	5.3
Philippines	8.6	5.8	7.8	5.0	...	...
Singapore	4.3	2.7	6.8	3.6	6.2	3.2
Thailand	...	...	9.7	5.8	10.2	5.8
Latin America						
Argentina	...	...	17.2	10.4	16.2	10.0
Brazil	...	2.7	...	3.0	...	3.4
Chile	...	...	7.8	6.8	...	...
Colombia	5.1	3.6	7.7	4.1	8.8	5.1
Mexico	...	1.4	...	5.7	...	6.4
Peru	...	[6.4]	18.5	16.5	19.6	16.0
Venezuela	...	2.5	...	14.9	...	3.9
CEE						
Czech Rep	5.2	3.4	8.5	5.6	9.6	5.9
Hungary	...	3.9	6.8	4.0	5.3	2.7
Poland	4.2	2.6	8.0	4.3	7.9	4.1
Russia	8.7	4.4	13.1	8.9	11.3	7.4
Turkey	1.7	1.0	3.8	1.1	4.0	1.9
Other EMEs						
Israel	8.5	6.2	11.0	6.2	11.1	6.3
Saudi Arabia	...	6.0	...	4.2	...	3.3
South Africa	17.6	9.2	17.3	8.3	18.0	10.6

[1] Includes bonds, notes and money market instruments. Average original and remaining maturities of central government amounts outstanding reported in Table 2e of the Working Group survey. Numbers in brackets represent the results of the 2001 survey published in BIS (2002, Table 6).   [2] These estimates should be regarded as indicative and may not be strictly comparable across countries.

Sources: CGFS Working Group survey; BIS, http://www.bis.org/statistics/secstats.htm item D4.

Graph A1

Exchange rate and aggregate positions in FX forwards and futures against domestic currency
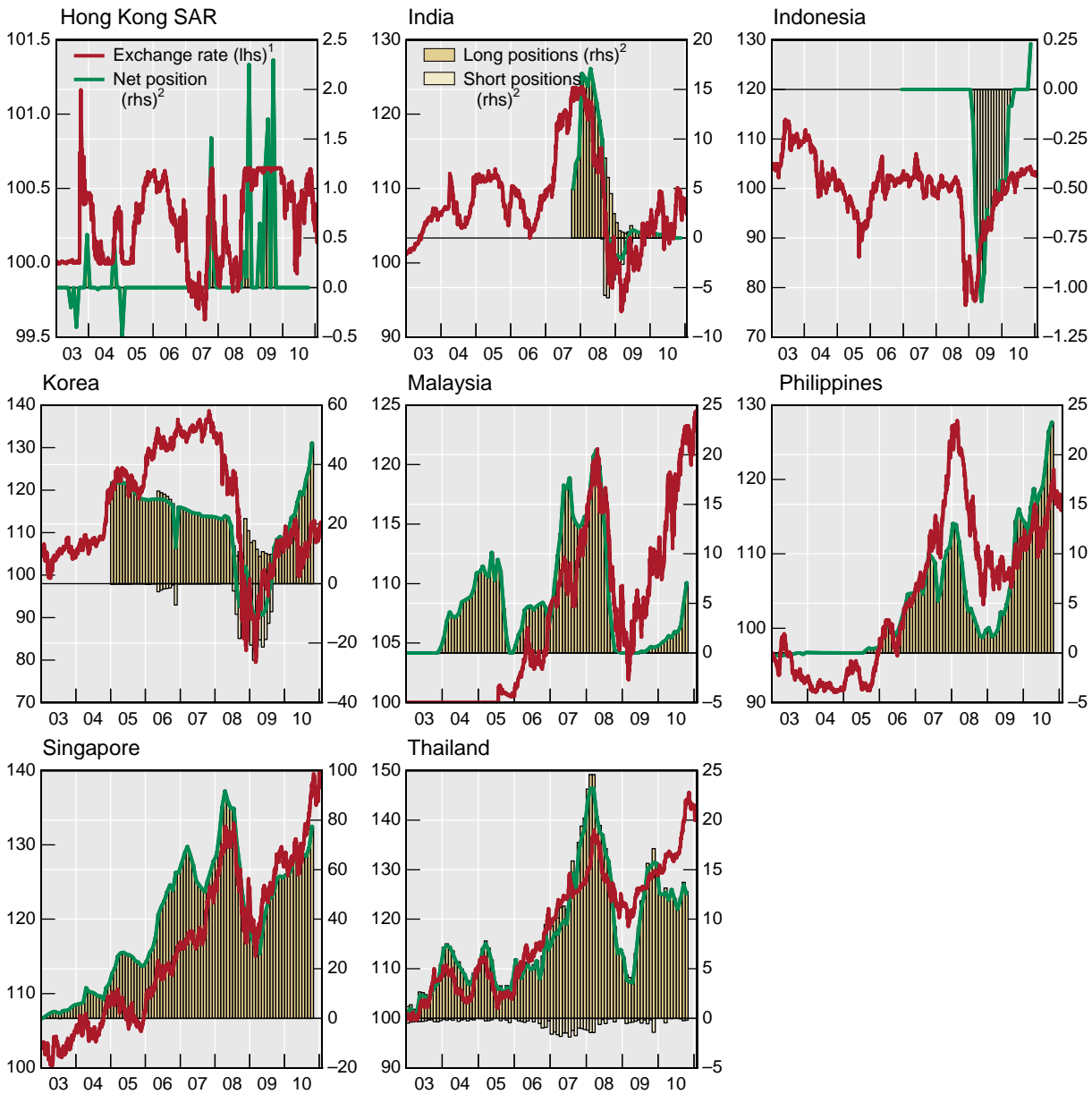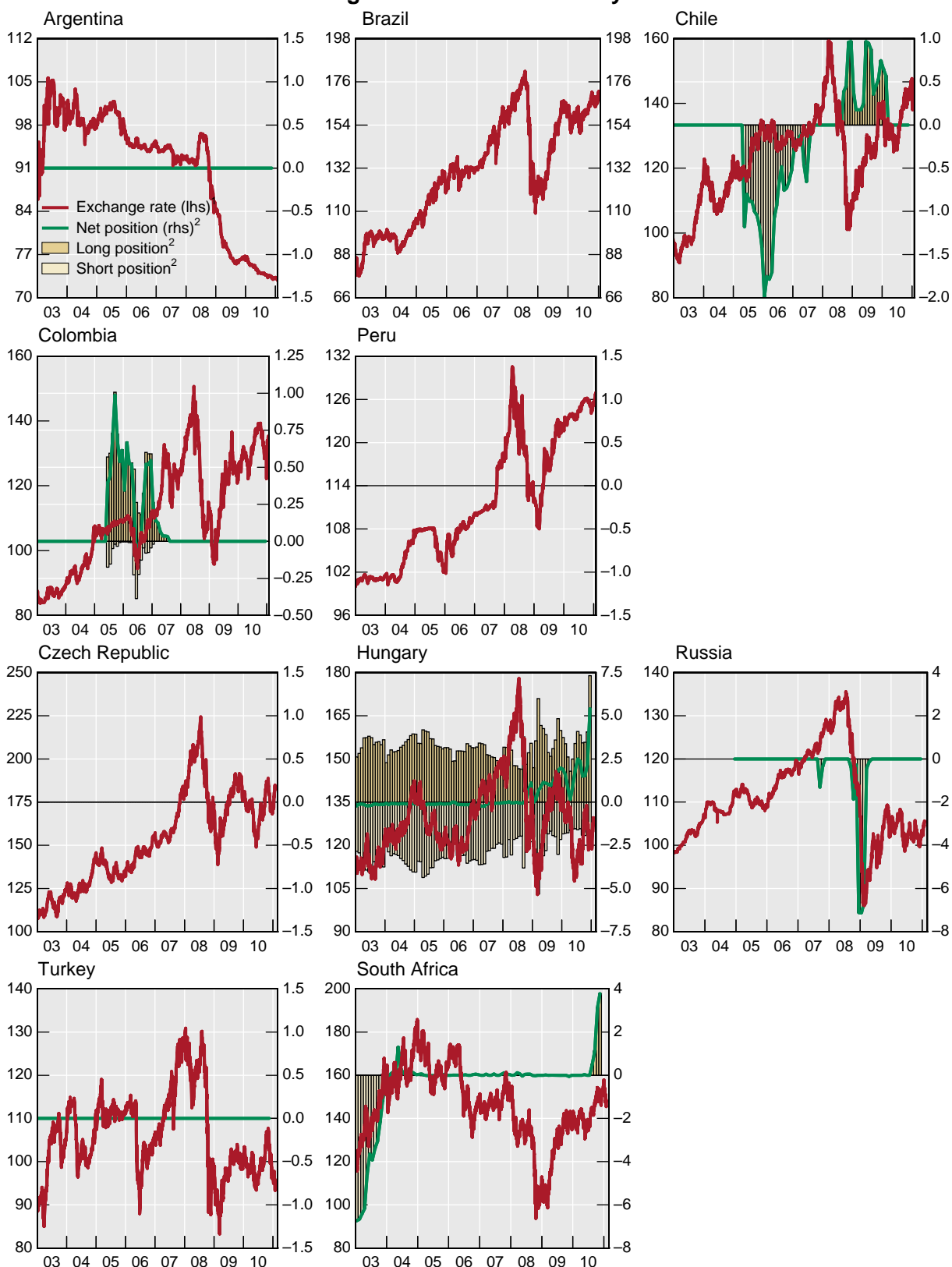

[1] 2002 = 100; an increase indicates appreciation of the local currency.   [2] Aggregate net, short (–) and long (+) positions in forwards and futures in foreign currencies vis-à-vis the domestic currency (including the forward leg of currency swaps); in billions of US dollars.

Source: IMF, *Data Template on International Reserves and Foreign Currency Liquidity.*

Graph A1 (cont)
Exchange rate and aggregate positions in FX forwards and futures against domestic currency

Argentina

Legend:
- Exchange rate (lhs)
- Net position (rhs)[2]
- Long position[2]
- Short position[2]

Brazil

Chile

Colombia

Peru

Czech Republic

Hungary

Russia

Turkey

South Africa

[1] 2002 = 100; an increase indicates appreciation of the local currency. [2] Aggregate net, short (−) and long (+) positions in forwards and futures in foreign currencies vis-à-vis the domestic currency (including the forward leg of currency swaps); in billions of US dollars.

Source: IMF, *Data Template on International Reserves and Foreign Currency Liquidity*.

References

Basel Committee on Banking Supervision (2006): *International convergence of capital measurement and capital standards: a revised framework*, Basel, June.

Committee on the Global Financial System (2007): "Financial stability and local currency bond markets", *CGFS Publications*, no 28, June.

——— (2009): "Capital flows and emerging market economies", *CGFS Publications*, no 33, January.

Kamil, H (2008): "Is central bank intervention effective under inflation targeting regimes? The case of Colombia", *IMF Working Papers*, no WP/08/88.

Jara, A, R Moreno and C Tovar (2009): "The global crisis and Latin America: financial impact and policy responses", *BIS Quarterly Review*, June.

Jeanne, O and R Rancière (2011): "The optimal level of international reserves for emerging market countries: a new formula and some applications", *Economic Journal*, June.

Klüh, U and P Stella (2008): "Central bank financial strength and policy performance: an econometric evaluation", *IMF Working Papers*, no WP/08/176.

Mesquita, M and M Toros (2010): "Brazil and the 2008 panic", in *The global crisis and financial intermediation in emerging market economies*, BIS Papers, no 54, December.

Mohan, R (2008): "Capital flows to India", in *Financial globalisation and emerging market capital flows*, BIS Papers, no 44, December.

Mohanty, M and P Turner (2006): "Foreign exchange reserve accumulation in emerging markets: what are the domestic implications?", *BIS Quarterly Review*, September.

Montoro, C and R Moreno (2011): "The use of reserve requirements as a policy instrument in Latin America", *BIS Quarterly Review*, March.

Moreno, R (2005): "Motives for intervention", in *Foreign exchange market intervention in emerging markets: motives, techniques and implications*, BIS Papers, no 24, May.

Peires, S (2010): "Foreign participation in emerging markets' local currency bond markets", *IMF Working Papers*, no WP 10/88.

Quizpe, Z and R Rossini (2010): "Monetary policy during the global financial crisis of 2007–09: the case of Peru", in *The global crisis and financial intermediation in emerging market economies*, BIS Papers, no 54, December.

Reinhart, C and V Reinhart (1999): "On the use of reserve requirements in dealing with capital flow problems", *International Journal of Finance and Economics*, vol 4, no 1, January, pp 27–54.

Sidaoui, J, M Ramos-Francia and G Cuadra (2010): "The global financial crisis and policy response in Mexico", in *The global crisis and financial intermediation in emerging market economies*, BIS Papers, no 54, December.

Vargas, H, Y Bettancourt, C Varela and N Rodríguez (2010): "Effects of reserve requirements in an inflation targeting regime: the case of Colombia", in *The global crisis and financial intermediation in emerging market economies*, BIS Papers no 54, December.