

The expansion of central bank balance sheets in emerging Asia: what are the risks?¹

Central bank balance sheets in emerging Asia expanded rapidly over the past decade because of the unprecedented rise in foreign reserve assets. The corresponding expansion of the central banks' liabilities has created dangers – risks of inflation and financial instability and financial market distortions – that require attention.

JEL classification: E58, E61.

What risks arise from the rapid expansion of central bank balance sheets in emerging Asia? This question has been attracting great interest in recent years because of the past decade's rapid increase of balance sheets to record levels. Most of the balance sheet growth has been in foreign exchange reserve assets, which to some extent reflects efforts to bolster such reserves in the aftermath of the late 1990s Asian financial crisis. Increasingly, however, the foreign reserve accumulation has been the by-product of resistance to appreciation of the domestic currency. Central banks have funded this asset accumulation in a variety of ways, including the extensive use of required reserves and remunerated excess reserves and the issuance of central bank paper.

This special feature explores whether the expansion of central bank balance sheets may contribute to risks of inflation and financial instability and to financial market distortions. The first section highlights the salient trends in central bank assets and liabilities in emerging Asia. The second discusses some of the policy risks that the expansion of central bank balance sheets may pose for the region. The third considers the policy challenges ahead.

The expansion of central bank balance sheets in emerging Asia

The size of central bank balance sheets in emerging Asia has reached historically high levels over the past decade (Graph 1). For the nine Asian

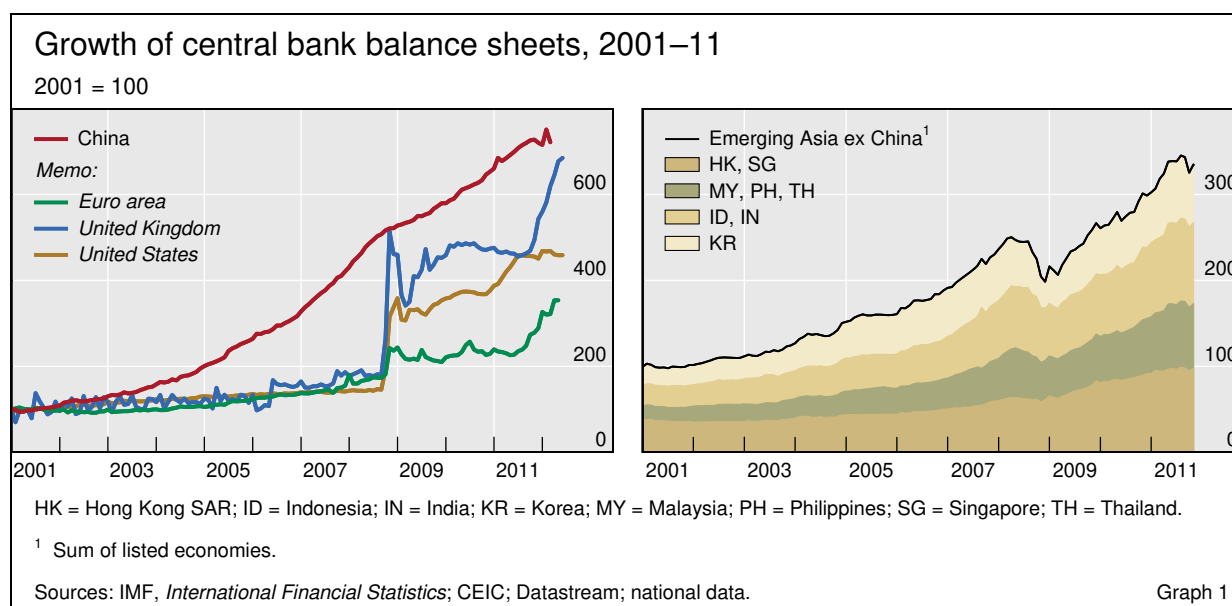
Central bank
balance sheets
have grown rapidly

¹ This article draws heavily on the presentations at the Bank of Thailand-BIS Research Conference entitled "Central bank balance sheets in Asia and the Pacific: the policy challenges ahead", held in Chiang Mai, Thailand, on 12–13 December 2011 (see www.bis.org/events/cbbsap.htm and *BIS Papers*, no 66 (2012)). The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We are grateful to Claudio Borio, Stephen Cecchetti, Dietrich Domanski, Robert McCauley, Philip Turner and Christian Upper for comments and to Lillie Lam for research assistance.

emerging economies in Graph 1, the combined size of the balance sheets increased from USD 1.1 trillion in 2001 to 6.4 trillion in 2011. China has clearly contributed to this trend, but the upward trajectory has been widespread across the region. In both Hong Kong SAR and Singapore, for example, the central bank balance sheet is now close to 100% of GDP; in China, Malaysia and Thailand, it is around 50%; and for the region as a whole, it is about 35% (Graph 2). Further, the ratios as a share of GDP in emerging Asia generally exceed those in advanced economies even after the substantial expansion in the latter following the recent crisis.²

To better understand the causes and implications of the balance sheet expansion, it is useful to consider the general asset and liability structure of a central bank (Table 1): assets consist of domestic and foreign assets, and liabilities comprise currency in circulation, bank reserves, central bank securities, government deposits, other non-monetary liabilities, and equity capital. Equity capital represents accumulated profits as well as paid-in capital. Policies that increase the size of central bank assets entail corresponding increases in liabilities – which can have important implications for the financial system.³

In recent years, central banks in emerging market economies, particularly in Asia, have used their balance sheets in a distinctly different way from those in advanced economies. In many advanced economies, central banks have purchased domestic assets to ease monetary conditions, and the increase in



² We should be careful not to over-interpret differences in the size of central bank balance sheets as a percentage of GDP. Central bank balance sheets reflect in many ways the structure of particular financial systems, a characteristic that varies widely across the economies in Graph 1. For example, Hong Kong SAR and Singapore are highly open international financial centres, and the advanced economies are generally larger and have higher degrees of financial development and currency internationalisation than the emerging economies.

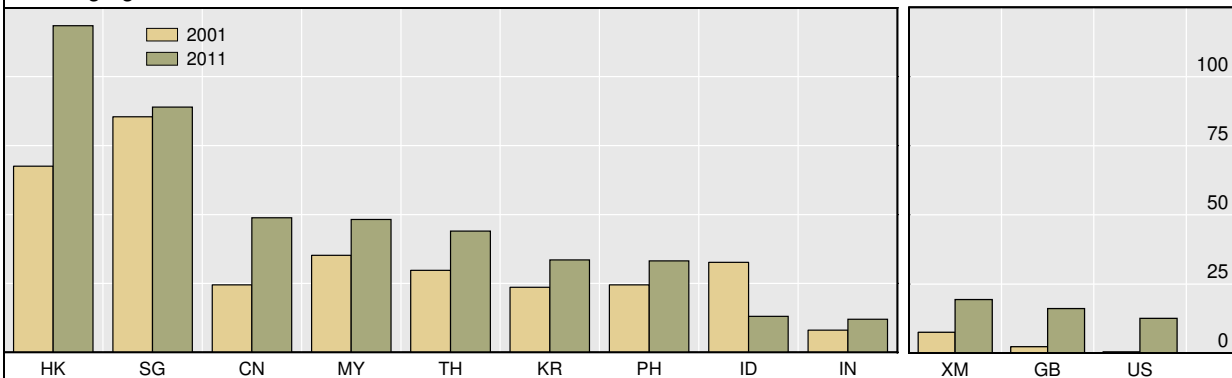
³ Mohanty and Turner (2006) argue that even if the large-scale expansion of central bank foreign exchange assets did not create near-term financial risks, it could aggravate financial system risks and make financial intermediation less efficient.

GDP share of central bank assets, 2001 and 2011¹

In per cent

Emerging Asia

Memo: advanced economies



CN = China; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; XM = euro area.

¹ Total assets net of currency in circulation.

Sources: IMF, *International Financial Statistics*; CEIC; Datastream; national data.

Graph 2

central bank assets has been accompanied by a corresponding increase in central bank liabilities, mainly in the form of bank reserves. In contrast, central banks in the Asian emerging market economies have intervened heavily in foreign exchange markets and accumulated foreign reserve assets. The financing of this accumulation (as seen on the liabilities side of the central bank balance sheet) has been achieved via the expansion of monetary liabilities (eg increasing bank reserves) and of non-monetary liabilities (eg greater issuance of central bank securities).

The ability of central banks to significantly alter the size of their balance sheets reflects their special public policy role and the powerful flexibility they have to use both their assets and liabilities to achieve policy goals. Traditionally, central banks have used the power of their balance sheets to act as lenders of last resort. The evolving roles of central banks have led them to make additional use of the balance sheet, not least to more actively pursue price and financial stability (Bernanke (2012)). However, the use of central bank balance sheets to effect change can also create unintended risks, as we will explore.

A central bank balance sheet

Assets	Liabilities
Foreign assets	Monetary liabilities
Domestic assets	Currency in circulation
	Bank reserves
	Non-monetary liabilities
	Central bank securities
	Government deposits
	Other liabilities
	Equity capital

Table 1

The remainder of this section further examines recent changes in central bank balance sheets in emerging Asia.

Assets

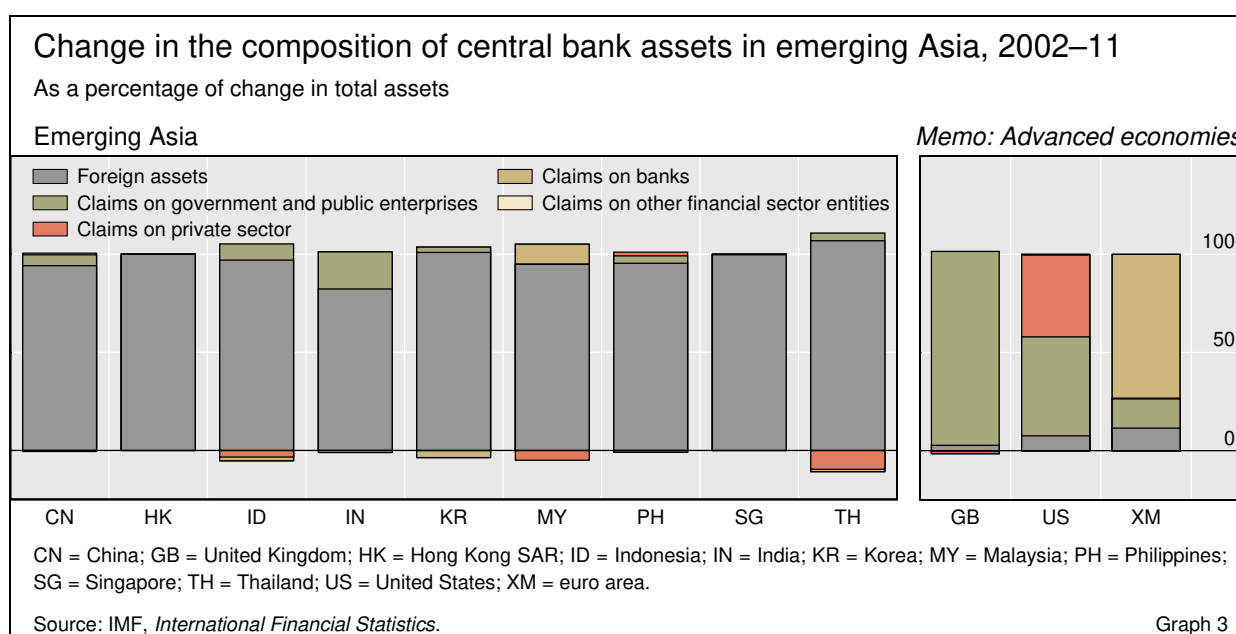
The remarkable increase in emerging Asia central bank assets has been dominated by the growth in foreign exchange reserve assets (Graph 3), mostly denominated in US dollars.⁴ But the main policy factors driving the growth of foreign exchange assets have changed over time.

Accumulation of foreign exchange reserves accounts for the bulk of the asset expansion

In the aftermath of the 1997–98 Asian financial crisis, policymakers took to heart the importance of having large foreign exchange reserves that could be used in the event of a run on their currencies. By helping to reassure markets that the exchange rate regime was sound and resilient, the reserve buffers lowered the likelihood of a run. And ample reserves remain a key factor determining an economy’s credit rating and thus its borrowing costs. By the second half of the 2000s, central banks in the region boosted reserves to a level that generally exceeded conventional import and external debt metrics of reserve adequacy.

Since the mid-2000s, the accumulation of foreign exchange reserve assets has been primarily a by-product of a policy that has resisted the currency appreciation pressures generated by trade and capital flows in the region. Central banks have tended to intervene in currency spot markets, buying foreign assets (predominantly US dollar-denominated) to ease the pressures.

In this regard as well, economic history in the region weighed on the minds of policymakers. One of the central lessons of the Asian financial crisis was that fixed exchange rates are hard to defend in the face of large and volatile capital flows and substantial changes in sentiment. Authorities also understood from



⁴ In contrast, the expansion of central bank balance sheets in the major advanced economies has largely consisted of the expansion of domestic currency assets, as Graph 3 indicates. See Table A1 in the Appendix for more detail.

historical experience that fully flexible exchange rate regimes can destabilise emerging economies. Against this backdrop, policymakers generally chose a middle ground of flexible but managed exchange rates. Although there were phases of heavy intervention to resist sharp depreciations, the more typical mode has been “leaning against the wind” in the face of appreciation pressure.

In theory, central banks could have accumulated foreign reserve assets by drawing down the domestic assets on their balance sheets and thereby limiting overall balance sheet growth. Indeed, in the years preceding the past decade, the large stock of government bonds on central bank balance sheets made selling government bonds a feasible option. Over the past decade, however, holdings of government bonds shrank relative to the growing size of foreign exchange reserve assets, causing central banks to increasingly finance asset accumulation via the expansion of liabilities.

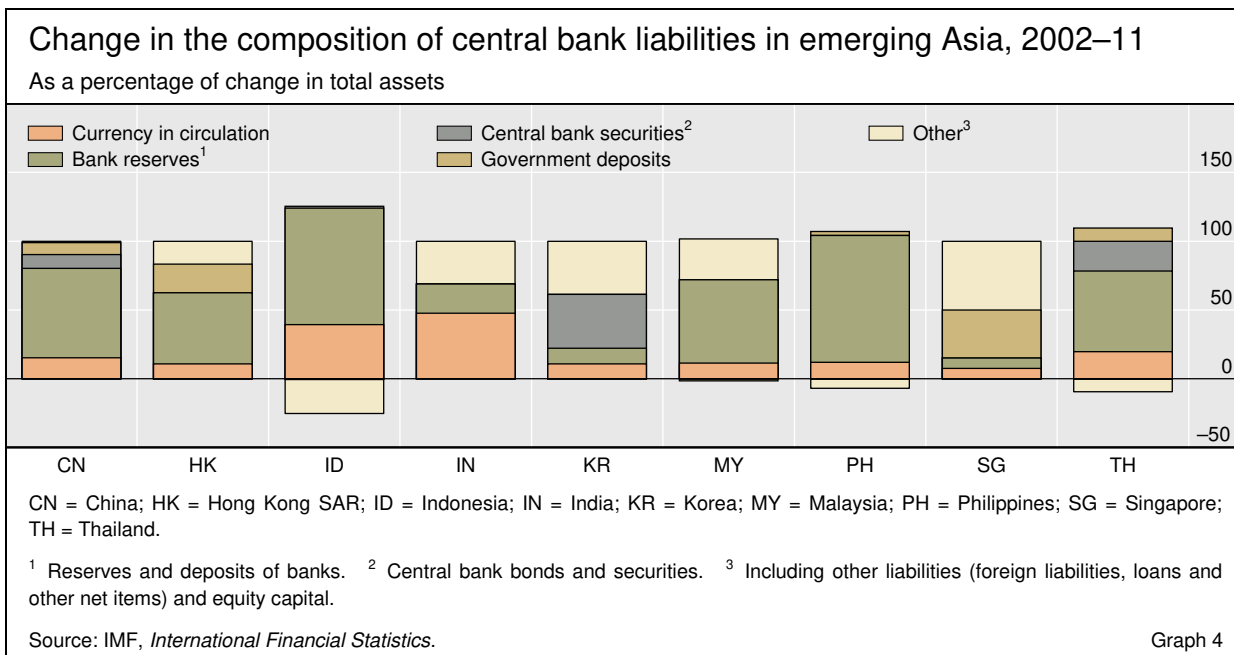
Liabilities

On the liabilities side, the composition of the expansion has been more varied

While the growth rate of the region’s central bank liabilities has mirrored that of its assets, the composition of the liabilities side has become relatively more diverse (Graph 4).⁵

Currency and bank reserves have risen sharply across most of emerging Asia. In part, this growth is due to financial deepening and strong underlying economic growth in the region. In addition, in several economies where strong credit growth and frothy asset prices have been an issue, central banks have imposed higher reserve requirements to curb the growth of bank lending.

Changes in government deposits have also been an important factor in some economies. These changes reflect both the role of the central bank as the

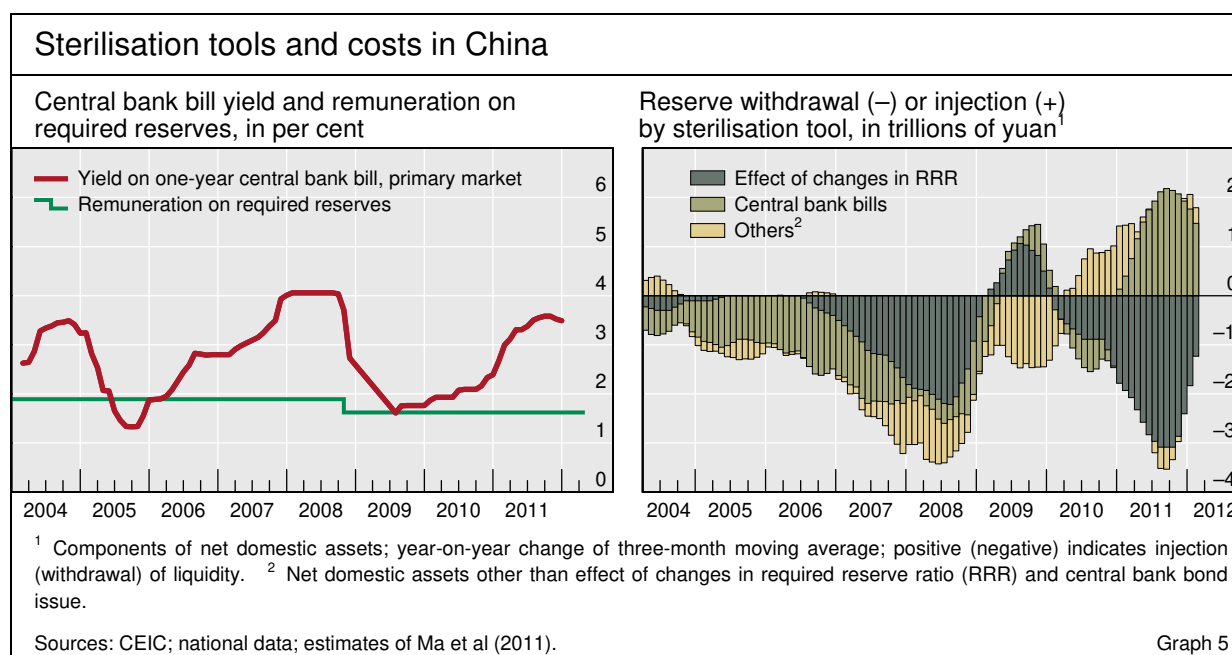


⁵ See Table A2 in the Appendix for more detail. BIS (2005) provides several country analyses of changes in central bank balance sheets in the emerging markets in the wake of foreign exchange intervention.

government's banker and its active use of government deposits as a means to sterilise foreign exchange intervention. The issuance of central bank paper and the use of remunerated excess reserves or deposit facilities, such as the special deposit accounts at Bangko Sentral ng Pilipinas, have also played an important role.⁶

The diversity in the structure of central bank liabilities reflects both the historical use of particular tools in a given jurisdiction and their relative cost (BIS (2005)). For example, two commonly used instruments are required reserve ratios and the issuance of sterilisation securities. These tools have different costs and benefits. Compared with issuing central bank securities, increasing reserve requirements tends to remove reserves from the banking system on a more permanent basis, and it is typically a low-cost option for central banks because the central banks pay little or no interest. In China, for example, this trade-off is apparent. In periods when the spread between the yield on central bank bills and the rate of remuneration on required reserves widened (eg in 2008 and 2011; Graph 5, left-hand panel), the People's Bank of China tended to rely more heavily on reserve requirements, instead of central bank bills, to withdraw reserves from the banking system (Graph 5, right-hand panel) (Ma et al (2011)). When the issuance of central bank bills was relatively less expensive, as was the case in the mid-2000s, the People's Bank of China used them instead.

Nonetheless, below-market remuneration on required reserves acts as a tax on domestic banks and thereby promotes the growth of shadow banking, ie the unregulated banking system. A related concern is that high-quality borrowers are the most likely to find alternatives to banks as sources of funding, which could lead over time to a decline in the credit quality of banks' loan portfolios.



⁶ In the case of India, the central bank and the government have an agreement under which the government issues the bonds and places the proceeds on deposit with the central bank. From a monetary policy perspective, this is equivalent to the central bank issuing the securities itself.

Risks

The size and structure of central bank balance sheets generate worrisome dangers, including ...

The size and structure of central bank balance sheets can create a number of policy risks and, in his keynote address at the recent Bank of Thailand-BIS conference, the General Manager of the BIS identified a number of them (Caruana (2011)). He argued, however, that because the materialisation of such risks is not inevitable, prudence dictates caution and vigilance. We provide some historical evidence to assess the growing threats in Asia from three sources: inflation risks, financial instability risks and the dangers arising from financial market distortions.

Inflation

... inflation ...

Traditionally, the rapid expansion of central bank balance sheets has been viewed as leading to growth in the monetary aggregates and, eventually, to higher inflation. In this view, however, the problem is not the size of the balance sheet per se; rather, it is the *rate of increase* in its size that matters. A high rate of increase can push the expansion of monetary liabilities beyond the ability of the financial system to absorb them in a manner consistent with balanced growth; at that point, inflationary pressures will be generated. Central banks may, however, be able to offset the effect on monetary liabilities by relying on the expansion of the non-monetary liabilities of the central bank.

In fact, the data suggest that the expansion of central bank balance sheets in emerging Asia does not pose an imminent risk of higher inflation. Central bank accumulations of foreign exchange reserves have reduced inflation pressures by sterilising the foreign exchange purchases via non-monetary liabilities and higher required bank reserves. The combination of this sterilisation and active monetary policy preserved price stability over the past decade and avoided excessive growth of base money despite the rapid accumulation of foreign exchange reserve assets. The effect can be seen by comparing the change in central bank assets with inflation from 2001 to 2011 (Graph 6), which indicates no statistical relationship between the two. The strong reputation for price stability built up over the past two decades by the region's central banks has also helped by keeping inflation expectations well anchored. Thus, inflation risks have been contained even in periods when the growth of broad money and credit accompanied the accumulation of foreign exchange assets.⁷

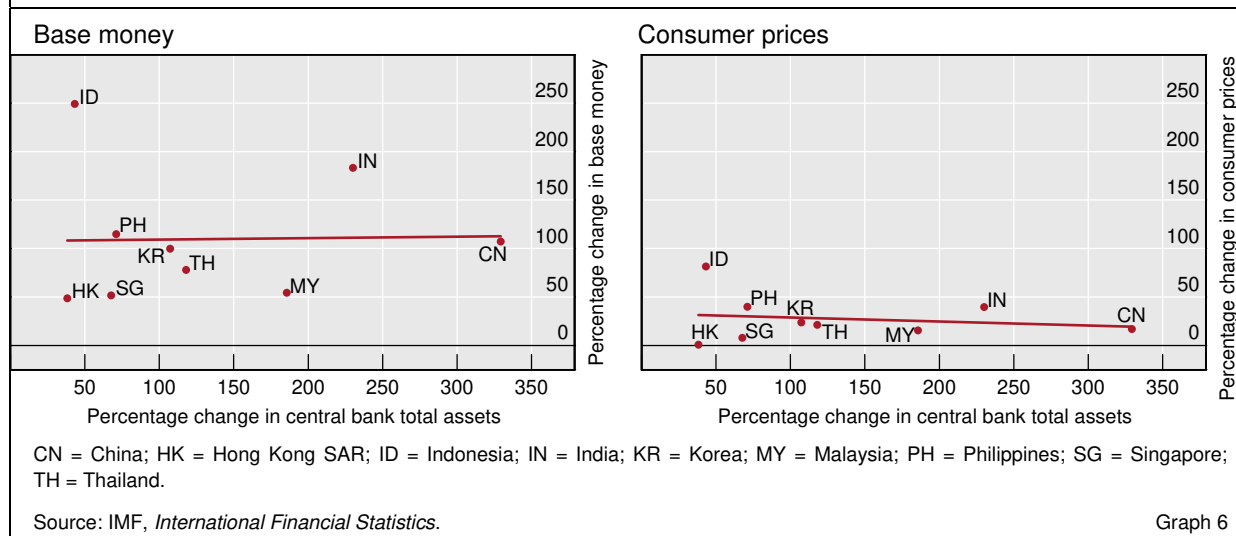
Moreover, the near-term inflation risks posed by expanding central bank balance sheets are generally hard to assess because of the well known long and variable lags in the effects of monetary policy. But two considerations point to the need for continued vigilance. First, the near-term unpredictability notwithstanding, a stable, positive longer-term correlation between central bank monetary liabilities and inflation still appears to hold.⁸ Second, the recent good performance of the region's central banks does not guarantee their future

⁷ This is consistent with the analysis of Borio and Disyatat (2010).

⁸ See Friedman and Schwartz (1982) for historical examples. BIS (2007, Graph IV.12, p 75) demonstrates that while correlations between money, credit and prices may be weak over short time horizons, it may be too soon to dismiss the relationships over long horizons.

Growth of central bank assets relative to the growth of money and consumer prices

2001–07



success. History contains numerous cases in which strong growth of central bank liabilities boosted price increases, such as the hyperinflation episodes that followed attempts to override fiscal constraints (Cagan (1956)). Thus, there is no room for complacency.

Financial instability

One of the risks posed by the accumulation of foreign reserves is that it will crowd out domestic lending. Cook and Yetman (2012) find evidence of this effect over the past decade in the balance sheets of 55 banks in Indonesia, Korea, Malaysia, the Philippines and Thailand. They find that a 1% increase in the level of foreign exchange reserves led to approximately a 1.3% decline in the growth rate of total loans made by banks over 2003–07.⁹ The effect arises because the banks ultimately increase their reserve holdings at the central bank and purchase more central bank sterilisation bills. This suggests that significant short-term run-ups of foreign asset reserve holdings would drain resources available for making loans, thereby contributing to domestic, regional and even global macroeconomic volatility in some cases.

... financial instability ...

Another risk is that the persistent expansion of central bank balance sheets may eventually lead private banks to rapidly expand credit, which could be destabilising. Over time, the massive accumulation of foreign exchange reserve assets at the central bank will generally result in an increase in low-yielding assets on the books of the private sector banks (assets that are sometimes called “lazy assets” because the commercial banks earn an interest margin on them without much effort). The composition of the lazy assets will depend on how the central bank finances its accumulation of foreign reserve assets. For

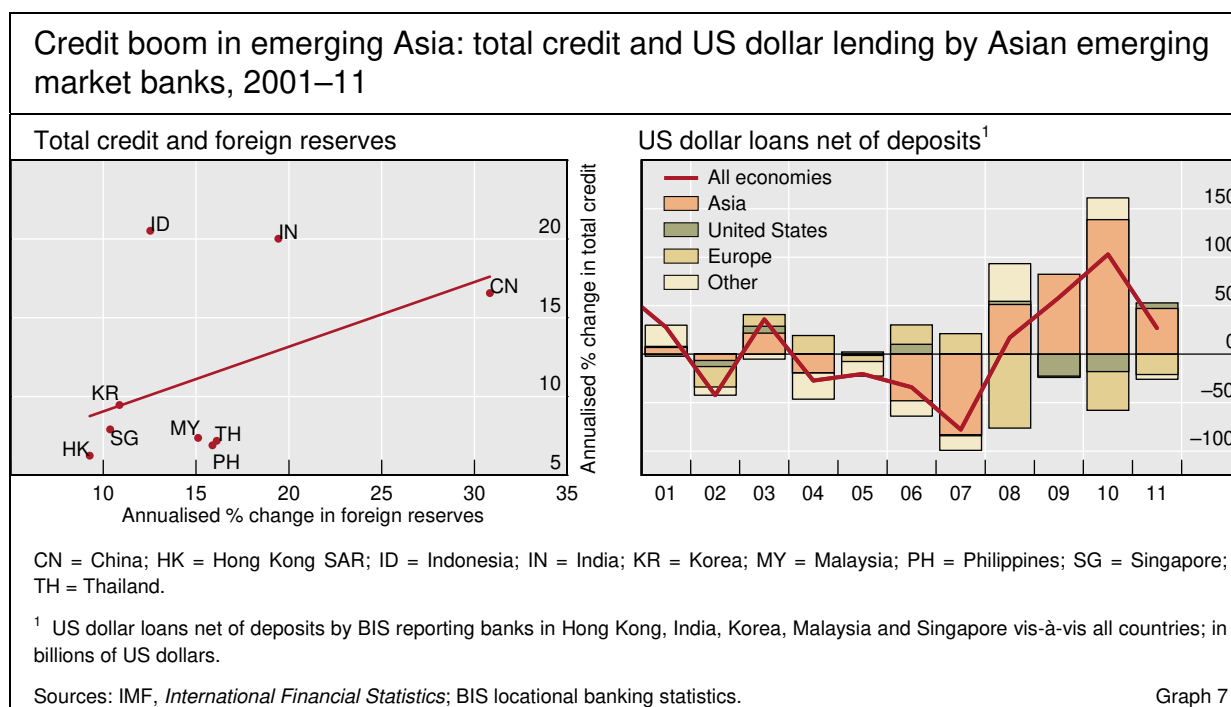
⁹ Similarly, Ho and McCauley (2008) report a negative relationship between reserve accumulation and the change in the loan-to-deposit ratios in Asia. This leaves open the question as to whether loans or deposits are driving the change. The results in Cook and Yetman (2012) suggest that declining loans are the primary driver.

example, central bank bills in emerging markets typically wind up on the balance sheets of the private sector banks.

The willingness of banks to hold these central bank securities will vary according to the macroeconomic and financial environment. When risk aversion is high, as it has been in emerging Asia for some time now, banks may find themselves being quite content to sit on these lazy assets. But as economic and financial conditions change, so will the willingness of banks to keep low-yielding assets on their balance sheets. The concern is that, at the time that the global recovery begins to gain traction and global risk aversion falls, these emerging market banks will attempt to either sell low-yielding assets to increase more profitable bank loans or leverage up to increase their return on equity. This search for yield would tend to amplify the boom phase of the recovery and eventually raise concerns of unsustainable lending and asset price growth.

Some evidence on credit growth from the region may be consistent with such dynamics: the rate of credit growth has been rapid in several economies where foreign reserves have also grown rapidly, particularly China and India (Graph 7, left-hand panel).¹⁰

The US dollar exposures of emerging Asian banks also display a worrisome trend consistent with a credit boom. These banks have been very active in extending US dollar loans without a corresponding increase in US dollar deposits in recent years (Graph 7, right-hand panel).¹¹ The willingness of central banks to resist currency appreciation appears to have encouraged private banks to take



¹⁰ Given the evidence in Graph 7, the causality between credit growth and foreign reserve asset accumulation could go either way. Rapid domestic credit growth leading to increased asset price returns would tend to draw increased capital inflows and hence foreign exchange reserve accumulation if authorities resist currency appreciation.

¹¹ See also Borio et al (2011) for further evidence on cross-border lending behaviour in Asia.

on additional foreign exchange rate risks (in the form of either currency mismatch risks or – if the banks swap out the foreign exchange rate risk in financial markets – counterparty risks).

To mitigate this risk of excessive credit growth, central banks could always rely on their domestic policy tools. To date, however, the stance of monetary policy in emerging Asia has remained distinctly accommodative: real policy interest rates are very low, and in some cases negative, despite shrinking output gaps. Moreover, the policy response may prove to be too cautious (Hannoun (2012)), in which case central banks may find themselves behind the curve. This is more likely to be the case if central banks find themselves focusing too much on the short-run costs of tightening monetary policy and too little on the risks associated with burgeoning balance sheets. For example, raising yields on sterilisation bills would increase the cost to central banks of sterilising the impact of past foreign reserve asset purchases. And a rapid increase in policy interest rates may be seen as disproportionately affecting the interest-sensitive sectors of the economy. History contains many instances of central banks struggling to limit bank credit expansion when the balance sheets of private sector banks are unusually liquid. Too rapid an expansion would have well known negative consequences for economic and financial instability.¹²

Financial market distortions

Another concern relates to distortions in financial markets. When an emerging market central bank finances its accumulation of foreign exchange assets with local currency assets traded in markets that are relatively thin, it tends to become the dominant player in the market.¹³ In those cases, distortions can arise from various sources.

... and financial market distortions

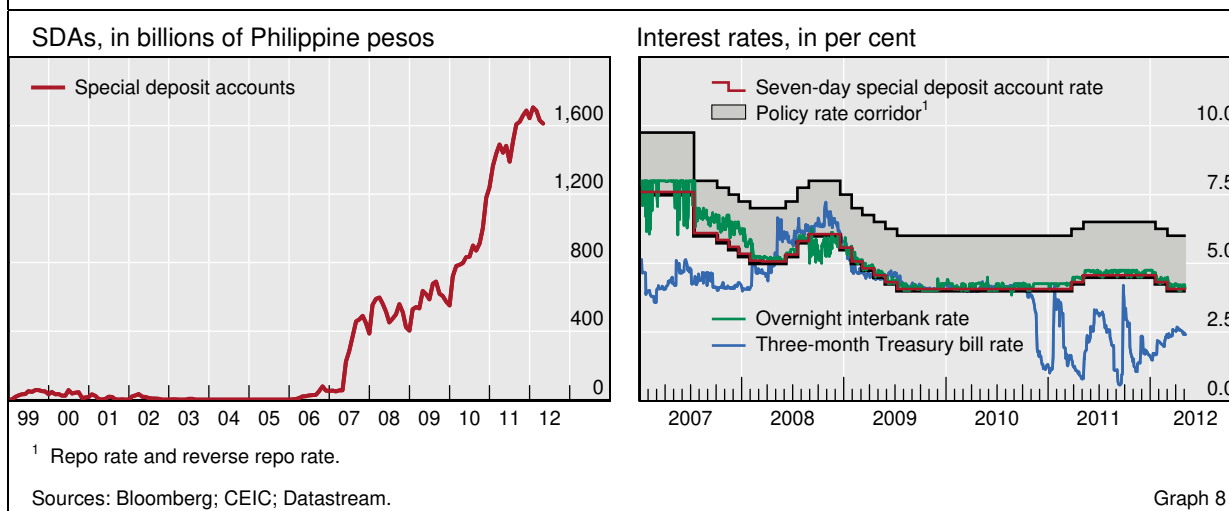
First, in pricing securities, central banks can have objectives that differ from those of the private sector, so their operations may distort interest rates and impair the efficient allocation of savings.¹⁴ Second, market participants may underweight private signals, so prices will tend to respond primarily to the expected moves of the central bank rather than to economic developments. Third, the sheer size of some central bank operations may displace the private

¹² Note also that the massive expansion of central bank balance sheets in the western advanced economies, conducted as part of their response to the international financial crisis, may be contributing to financial stability risks in emerging Asia. Chen et al (2012) find evidence that large-scale asset purchases by the US Federal Reserve lowered yield curves in Asia as well as in the United States. The lower interest rates have driven up credit and asset prices in a number of Asian economies. For a further discussion of the issues associated with the transmission of central bank balance sheet expansions, see Iwata and Takenaka (2012), who emphasise the exchange rate and terms of trade channels. For a more positive perspective on the role of central bank balance sheet policies, see Chadha et al (2012).

¹³ Mehrotra (2012) notes that the outstanding stock of central bank paper in some Asian economies now exceeds 10% of GDP. But it is also true that, because central bank operations in local currency assets help banks manage their reserves more effectively, the operations over time should encourage the deepening of domestic financial markets.

¹⁴ Sometimes, however, central banks want to use balance sheet expansions to directly influence private sector incentives. For example, quantitative easing in the advanced economies is explicitly intended to alter the yield curve and hence the allocation of savings from what would otherwise be the case.

Special deposit accounts and interest rates of the Philippines



sector in financial intermediation. Finally, heavy reliance on the central bank in the financial intermediation process can stifle financial market development, especially in emerging market economies.¹⁵

One interesting example of distortion is currently playing out in the Philippines. The aggregate size of the central bank's special deposit accounts (SDAs),¹⁶ introduced to withdraw excess liquidity from the market, has skyrocketed since 2007 (Graph 8, left-hand panel); they are now approximately twice as large as the total required reserves of depository institutions. One result has been the convergence of the overnight interest rate to the SDA rate, which runs slightly above the floor of the policy rate corridor (Graph 8, right-hand panel). The expansion of the SDAs has been associated with greater reliance on the SDA rate, rather than the short-term Treasury bill rate, as a benchmark for pricing fixed income instruments; the three-month Treasury bill rate has been quite volatile since late 2010.

Additional policy challenges ahead

Large balance sheets pose a number of other ongoing challenges for monetary policy.

Central bank finances, independence and credibility

Large balance sheets are weakening central bank finances in Asia

Large balance sheets leave central banks vulnerable to large financial losses (Filardo and Grenville (2012)). These potential losses can mount in a variety of ways. First, the central bank's return on its foreign assets is typically less than

¹⁵ Monetary policy operations can also play a positive role in certain circumstances. McCauley (2008) discusses how monetary policy operations can contribute to financial market development and Durré and Pill (2012) emphasise how operations can help overcome market distortions during crisis periods.

¹⁶ SDAs are fixed-term investment deposits available to banks and trust entities of financial institutions supervised by the Philippine central bank, which in turn uses the accounts to manage the reserves of the banking system.

the running cost of financing these foreign assets. That is, the assets may yield less than the costs of central bank bills and the interest rate paid on excess reserves. Second, the central bank incurs losses on the domestic value of its foreign exchange reserve assets when its domestic currency appreciates. Third, the assets on the balance sheets of central banks may be subject to mark-to-market losses as creditworthiness deteriorates and market interest rates rise. In some cases, losses could also be realised because of a credit event.

Admittedly, such losses can affect the profit and loss statement of a central bank and reduce its capital without directly threatening its ability to achieve policy goals; indeed, the losses may be fully consistent with those goals. But the accumulation of losses can have indirect effects. A particular concern is the reporting of large losses; the news could raise questions about the reputation of the central bank, and if a central bank has to go cap in hand to the treasury or legislature for an injection of capital, it may find its independence at risk. A recent BIS report analyses the implications of financial risks for central bank governance arrangements.¹⁷

Exit strategies

The three risks outlined above – inflation, financial instability and market distortions – need to be carefully managed and thus merit further analysis. Serious consideration should also be given to capping and then shrinking the size of central bank balance sheets. Indeed, the central banks of India, Korea and Malaysia reduced their holdings of foreign assets during the international financial crisis (Graph 9) in response to extreme exchange rate volatility and capital outflows. Other central banks, including those of the Philippines and Thailand, were reluctant to allow their long positions to decrease during the crisis because of concerns about the potential for credit rating downgrades and their knock-on effects. In recent months, outright and net forward positions have declined somewhat further in some regional economies.

Exit strategies
entail difficult policy
choices

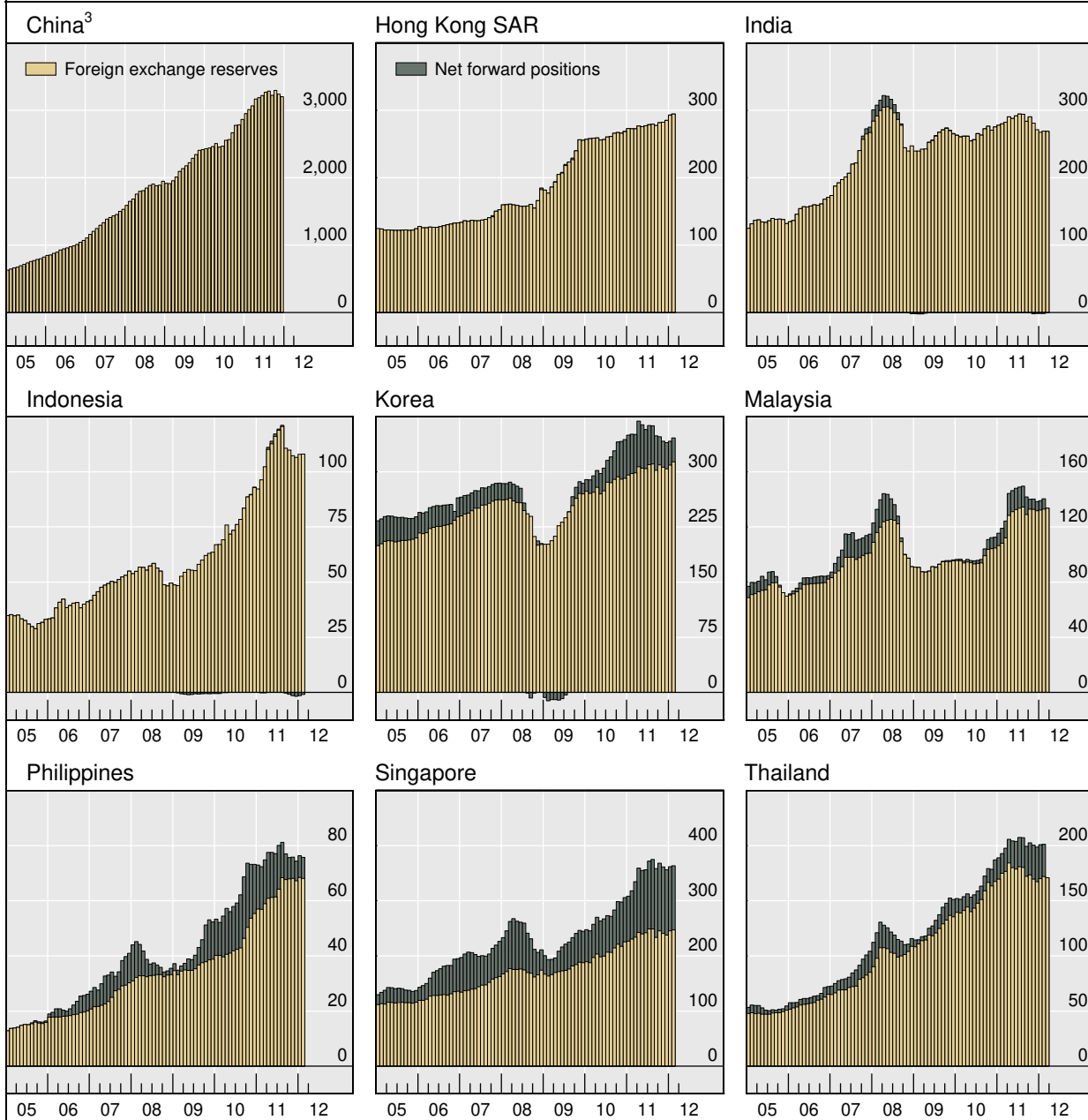
Limiting the expansion of central bank balance sheets may be easier said than done. After all, the massive expansion in Asia in recent years was often the by-product of exchange rate regimes that resisted exchange rate pressures. Greater tolerance of currency appreciation over time could be a key element of a framework to limit further accumulation of foreign assets.¹⁸ The economics that would guide the pullback and the central bank operations to achieve it are both fairly straightforward, but the political economy issues are more complex.

¹⁷ BIS (2011, pp 45–7). See also Trairatvorakul (2012) for a discussion of the various economic and political costs associated with the build-up of foreign reserves.

¹⁸ In addition, Gagnon (2012) argues that the large accumulation of foreign exchange assets at central banks has driven a substantial portion of global current account imbalances. Hence, exiting would contribute significantly to the global economic recovery.

Foreign exchange reserves¹ and net forward positions²

In billions of US dollars



¹ Official reserves excluding gold. Includes SDR and reserve positions in the IMF. ² Long positions in forwards and futures in foreign currencies vis-à-vis the domestic currency, minus short positions. ³ Data of net forward positions are not available for China.

Sources: IMF, *International Financial Statistics* and *International Reserves and Foreign Currency Liquidity*; national data. Graph 9

Conclusions

The rapid expansion of central bank balance sheets arising from many years of foreign exchange reserve accumulation in emerging Asia is raising concerns about inflation, financial instability and financial market distortions. Serious deterioration in these areas has not yet materialised, but analysis highlights the need for a further careful assessment of both the historical record and current institutional arrangements. The recent Bank of Thailand-BIS conference made some progress in clarifying the implications of these developments. Further

analysis is needed. Financial stability risks can take many forms and must not be underestimated. Credit developments in emerging Asia might be more worrying in light of the soaring central bank balance sheets. At the operational level, the management of ballooning central bank balance sheets raises concerns about distortions in financial markets and implications of central bank losses.

The temptation to look only at the size and composition of central bank balance sheets should be tempered by the fact that they are a by-product of underlying public policies and the choice of instruments to implement those policies. To improve the health of the balance sheets, central banks and governments would have to reflect on how they should alter such policies. The approach to exchange rate management by countries in emerging Asia is a critical factor, and various reform efforts are currently being considered. Although such efforts are largely driven by the implications of exchange rate management for global imbalances and growth, the risks associated with the size and structure of central bank balance sheets should not be overlooked.

References

Bank for International Settlements (2005): “Foreign exchange market intervention in emerging markets: motives, techniques and implications”, *BIS Papers*, no 24.

——— (2007): *77th Annual Report*, June.

——— (2011): “Central bank governance and financial stability: a report by a study group”, May, www.bis.org/publ/othp14.htm.

Bernanke, B (2012): “The Federal Reserve and its role in today’s economy”, March, www.federalreserve.gov/newsevents/lectures/about.htm.

Borio, C and P Disyatat (2010): “Unconventional monetary policies: an appraisal”, *Manchester School*, no 78, s1, pp 53–89.

Borio, C, R McCauley and P McGuire (2011): “Global credit and domestic credit booms”, *BIS Quarterly Review*, September, pp 43–57.

Cagan, P (1956): “The monetary dynamics of hyperinflation”, in M Friedman (ed), *Studies in the quantity theory of money*, University of Chicago Press.

Caruana, J (2011): “Why central bank balance sheets matter”, keynote address at the Bank of Thailand-BIS Research Conference entitled “Central bank balance sheets in Asia and the Pacific: the policy challenges ahead”, Chiang Mai, Thailand, 12–13 December, www.bis.org/speeches/sp111216.pdf.

Chadha J, L Corrado and J Meaning (2012): “Reserves, liquidity and money: an assessment of balance sheet policies”, *BIS Papers*, no 66, forthcoming.

Chen, Q, A Filardo, D He, and F Zhu (2012): “International spillovers of central bank balance sheet policies”, *BIS Papers*, no 66, forthcoming.

Cook, D and J Yetman (2012): “Expanding central bank balance sheets in emerging Asia: a compendium of risks and some evidence”, *BIS Papers*, no 66, forthcoming.

Durré, A and H Pill (2012): “Central bank balance sheets as policy tools”, *BIS Papers*, no 66, forthcoming.

Filardo, A and S Grenville (2012): “Central bank balance sheets and foreign exchange rate regimes: understanding the nexus in Asia”, *BIS Papers*, no 66, forthcoming.

Friedman, M and A Schwartz (1982): *Monetary trends in the United States and the United Kingdom: their relation to income, prices, and interest rates, 1867–1975*, University of Chicago Press.

Gagnon, J (2012): “Global imbalances and foreign asset expansion by developing-economy central banks”, *BIS Papers*, no 66, forthcoming.

Hannoun, H (2012): “Monetary policy in the crisis: testing the limits of monetary policy”, speech at the 47th SEACEN Governors’ Conference, Seoul, Korea, 13–14 February.

Ho, C and R McCauley (2008): “The domestic financial consequences of reserve accumulation: some evidence from Asia”, in R Rajan, S Thangavelu and R Parinduri (eds), *Exchange rate, monetary and financial issues and policies in Asia*, World Scientific, Singapore.

Iwata, K and S Takenaka (2012): “Central bank balance sheets expansion: Japan’s experience”, *BIS Papers*, no 66, forthcoming.

Ma, G, X Yan and X Liu (2011): “China’s evolving reserve requirements”, *BIS Working Papers*, no 360.

McCauley, R (2008): “Developing financial markets and operating monetary policy in Asia”, *BIS Papers*, no 39, April.

Mehrotra, A (2012): “On the use of sterilisation bonds in emerging Asia”, *BIS Papers*, no 66, forthcoming.

Mohanty, M and P Turner (2006): “Foreign exchange reserve accumulation in emerging markets: what are the domestic implications?”, *BIS Quarterly Review*, September, pp 39–52.

Trairatvorakul, P (2012): “Regional challenges ahead – dealing with capital flows, prolonged exchange rate intervention and their consequences in Asia and the Pacific”, *BIS Papers*, no 66, forthcoming.

Appendix: Composition of central bank assets and liabilities in Asian emerging economies

Assets								
In billions of US dollars								
	Foreign assets		Claims on financial sector		Claims on public sector		Other claims	
	2002	2011	2002	2011	2002	2011	2002	2011
China	280.80	3,775.62	235.92	331.56	34.60	244.40	2.50	0.40
Hong Kong SAR	106.81	280.47	...	...	...	...	...	...
India	70.36	285.67	2.25	1.73	24.78	84.84	...	...
Indonesia	32.86	110.37	1.89	0.49	34.32	36.39	4.11	1.33
Korea	130.97	308.61	5.77	3.50	8.29	13.98	...	...
Malaysia	34.58	133.29	1.66	11.34	0.16	0.63	6.28	3.47
Philippines	16.42	75.77	0.61	0.67	3.96	6.77	1.08	1.83
Singapore	82.19	237.20	...	...	3.34	5.24	...	...
Thailand	39.29	176.89	1.93	...	2.50	8.84	10.14	...

Source: IMF, *International Financial Statistics*. Table A1

Liabilities										
In billions of US dollars										
	Currency in circulation		Bank reserves ¹		Central bank securities ²		Government deposits		Other liabilities	
	2002	2011	2002	2011	2002	2011	2002	2011	2002	2011
China	208.74	805.42	336.59	2,774.24	17.97	370.37	37.28	360.80	-49.41	37.68
Hong Kong SAR	14.49	31.94	17.07	106.62	...	...	38.69	85.44	-5.40	-16.67
India	54.34	183.63	17.25	78.14	...	...	0.03	0.03	24.39	109.17
Indonesia	11.01	41.13	17.82	83.20	...	1.03	12.85	9.88	17.97	4.61
Korea	16.75	36.19	15.29	33.36	88.46	153.59	9.42	6.39	3.15	93.78
Malaysia	7.14	19.48	24.31	84.31	...	...	1.96	6.31	1.31	27.94
Philippines	5.12	12.79	4.78	59.72	...	...	1.49	3.68	6.24	...
Singapore	7.12	18.98	4.38	15.95	...	...	54.36	110.80	19.67	96.72
Thailand	12.96	39.40	5.85	80.28	2.60	29.88	1.55	12.55	-6.81	5.01

¹ Reserves and deposits of banks. ² Including central bank bonds.
Source: IMF, *International Financial Statistics*. Table A2