

Central bank balance sheets and foreign exchange rate regimes: understanding the nexus in Asia

Andrew Filardo and Stephen Grenville¹

Abstract

Central bank balance sheets in emerging Asia have been expanding rapidly for the past decade, driven primarily by the accumulation of foreign exchange reserves. Some of the expansion reflects efforts to increase the buffer stock of reserves in the aftermath of the 1997–98 Asian Financial Crisis. Increasingly, however, the reserve accumulation has been the by-product of exchange rate regimes that have in practice tended to resist appreciation. At the same time, policymakers in the region have been able to achieve price stability and bolster financial stability.

This policy experience in Asia is changing the consensus about the trade-off between fixed and floating exchange rate regimes. The past decade has shown that an intermediate approach in Asia has emerged as being both feasible and, by revealed preference, desirable. But this choice however is not without its costs. The unprecedented expansion in the region's central bank balance sheets has increased the carrying cost for central banks and exposed them to significant re-valuation risks as exchange rates and interest rates fluctuate. This paper also introduces concerns about the rise of 'lazy assets' on the balance sheets of private sector financial institutions. These assets are associated with the sterilisation purchases of foreign exchange assets by central banks which, over time, could contribute to financial instability. Conclusions are drawn about the need for more sustainable Asian monetary policy and exchange rate regimes.

Keywords: Central bank balance sheets, foreign reserve assets, exchange rate sterilisation, lazy assets, fundamental equilibrium exchange rate (FEER), carrying costs, monetary stability, financial stability

JEL classification: E58, E61, F31, F33

¹ Head of Economics for Asia and the Pacific, Bank for International Settlements; Visiting Fellow, Lowy Institute, respectively. This paper was written while Stephen Grenville was visiting the Asian Office of the BIS in 2011. The views expressed are those of the authors and do not necessarily represent those of the Bank for International Settlements.

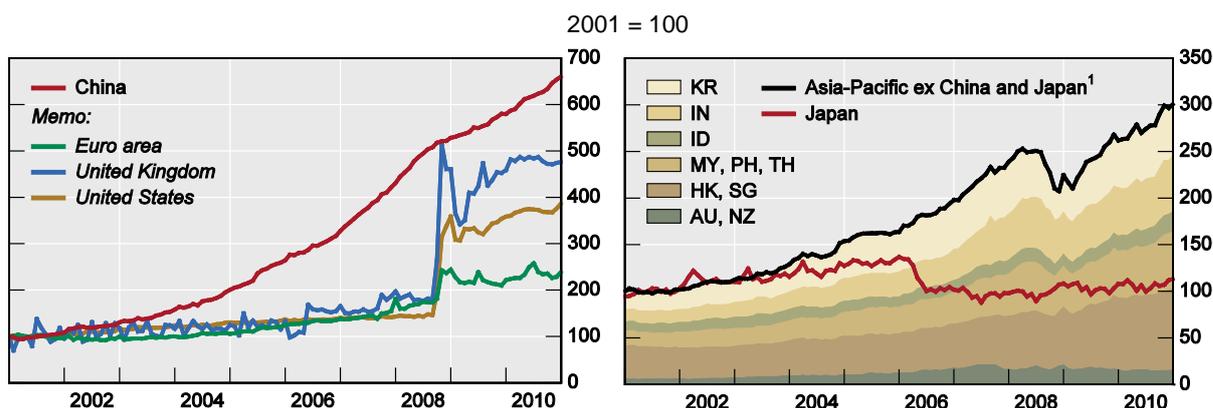
Introduction

Central bank balance sheets in emerging Asia have been expanding rapidly for the past decade, driven primarily by the accumulation of foreign exchange reserves (Graph 1). Some of the expansion reflects efforts to increase the buffer stock of reserves in the aftermath of the 1997–98 Asian crisis. Increasingly, however, the reserve accumulation has been the by-product of regimes for exchange rates that have in practice tended to resist appreciation.² At the same time, policymakers in the region have been able to maintain price stability and bolster financial stability.

This policy experience in Asia is changing the consensus about the trade-off between fixed and floating exchange rate regimes. At one time, it was thought that the choice was binary: either freely float or fix. The past decade has shown that a third, intermediate, approach has emerged in practice as being both feasible and, by revealed preference, desirable.

However, this third way is not without its costs. The resistance to exchange rate appreciation has led to an unprecedented expansion in the region's central bank balance sheets. Concerns have risen about the implications for macroeconomic and financial stability. Looking forward, it is natural to ask how much longer this rapid and costly asset accumulation can and should go on. And, if it can't go on forever, what will happen when the accumulation stops or even goes into reverse?

Graph 1
Central bank total assets



AU = Australia; HK = Hong Kong SAR; ID = Indonesia; IN = India; KR = Korea; MY = Malaysia; NZ = New Zealand; PH = Philippines; SG = Singapore; TH = Thailand.

¹ Sum of listed economies.

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

This paper explores the challenges that the expansion of central bank balance sheets poses for policymakers in emerging Asia. We first look at the experience of reserve accumulation, focusing on the implications for monetary and financial conditions through the lens of the size and complexity of central bank balance sheets. Then we look at the challenges in managing

² In the advanced economies, by way of contrast, policy actions taken in response to the recent international financial crisis account have also resulted in a sharp expansion in central bank balance sheets, but the causation has been quite different. The Federal Reserve, Bank of England and ECB, for example, have seen their balance sheets grow sharply since mid-2008, as these central banks adopted extraordinary measures to combat the effects of the international financial crisis and the sovereign debt problems in Europe. For Japan, the relevant period is in the late 1990s and early 2000s.

the assets and liabilities of these large central bank balance sheets, before drawing some conclusions about sustainable Asian monetary policy and exchange rate regimes.

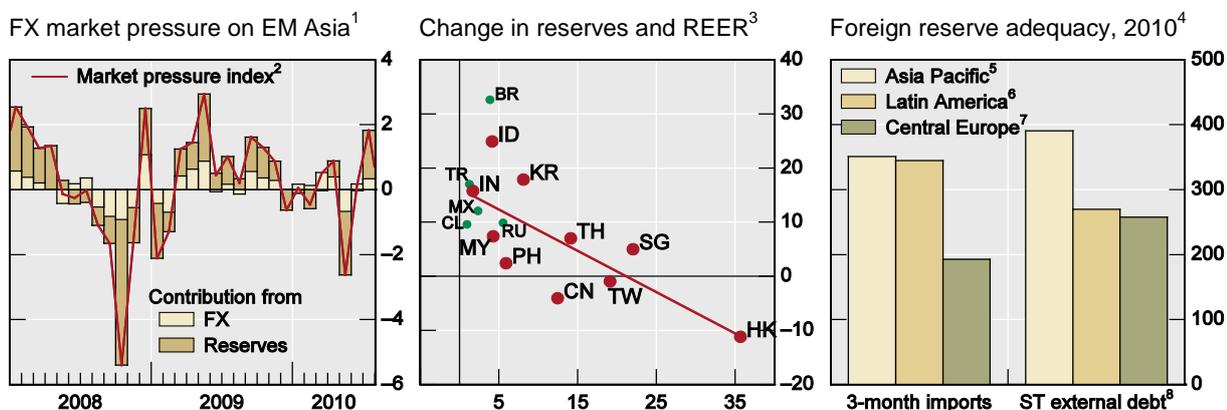
I. The expansion of Asian central bank balance sheets

The rapid expansion of Asian central bank balance sheets has been driven primarily by exchange rate concerns. Soon after the Asian crisis, the region's policymakers took to heart the importance of having a sufficient war-chest of reserves. At least in theory, the reserves were there to deter a run on the currency and assure markets that the exchange rate regime was sound. Indeed, credit rating agencies took reserve holdings as one of the key factors determining an economy's credit rating, and thus influencing the cost of local currency borrowing.

By the second half of the 2000s, Asia as a whole was seen as having reserves that were ample according to conventional import and external debt metrics (right-hand panel of Graph 2 and Table A1 in the Annex). With adequate (or more than adequate) reserves, the rationale for continuing to accumulate them was to resist exchange rate appreciation (Graph 2, left-hand and centre panels).

Moves to resist exchange rate appreciation did not imply a reversion to fixed exchange rates. One of the central lessons of the Asian crisis was that fixed exchange rates were hard to defend in the face of large and volatile foreign capital flows coupled with substantial changes in sentiment. But nor did the authorities accept the argument that those countries which could not credibly peg indefinitely should float freely.³

Graph 2
Reserves and exchange rates



BR = Brazil; CL = Chile; CN = China; HK = Hong Kong SAR; ID = Indonesia; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PH = Philippines; RU = Russia; SG = Singapore; TH = Thailand; TR = Turkey; TW = Chinese Taipei.

¹ China, Hong Kong SAR, Indonesia, India, Korea, Malaysia, Philippines, Singapore and Thailand. ² Defined as sum of normalised change in nominal exchange rate against US dollar and ratio of normalised change in international reserves to narrow money. ³ Vertical axis: percentage change in real effective exchange rate (REER) from Q1 2009 to Q3 2010 (increase = appreciation); horizontal axis: change in foreign reserves from Q1 2009 to Q3 2010 as a percentage of GDP. ⁴ In per cent; average of the economies in the region. ⁵ Australia, China, Hong Kong SAR, Indonesia, India, Japan, Korea, Malaysia, New Zealand, Pakistan, Philippines, Singapore and Thailand. ⁶ Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. ⁷ The Czech Republic, Hungary and Poland. ⁸ Short-term external debt measured as consolidated international claims of BIS reporting banks with a maturity up to and including one year, plus international debt securities outstanding with a maturity up to one year.

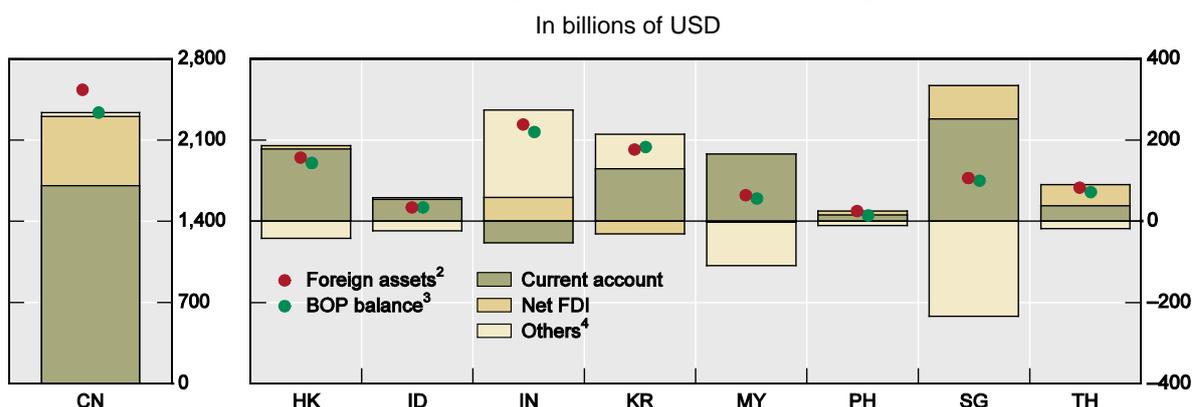
Sources: IMF, *International Financial Statistics*; Datastream; BIS; national data.

³ See Fischer (2001) for a discussion at the time of the range of views on bipolar exchange rate regimes.

The record in Asia suggests that reality is not so simple. While Malaysia continued its peg until 2005, China had periods of fixity, Hong Kong SAR maintained a fixed rate via its currency board, and Singapore chose a targeted approach, most countries of the region adopted a flexible exchange rate framework. They did not, however, choose a purely free float. The exchange rate regime of choice was a managed float, where the degree of market-determination varied across economies and over time. There were also times of heavy intervention to resist sharp depreciations, notably in Korea and Indonesia during the recent international financial crisis. But the more typical mode was “leaning against the wind” in the face of appreciation pressure, which helps to account for the trend accumulation of reserves.

Another manifestation of this overall policy approach was the current account which, having generally been in deficit before the crisis, now moved substantially in the direction of surplus (Graph 3). While the international policy debate has raised questions about the persistence of these surpluses, the countries affected by the Asian crisis were keenly conscious of the vulnerability that accompanies external deficits. Thus the increase in foreign exchange reserves generally reflected *both* current account surpluses and strong capital inflows. There were, of course, exceptions to this generalisation. For example, India’s current account was in deficit, and both Singapore and Malaysia had net capital outflows over the period.

Graph 3
Balance of payments and foreign assets, cumulative change from 2000 to 2009¹



¹ Data as of end-2008 for Indonesia, India, Malaysia, Philippines and Thailand. ² Changes in foreign assets (line 11 IFS) over the observation period. ³ Sum of overall balance for the observation period. ⁴ Net sum of BOP components other than current account and direct investment.

Source: IMF, International Financial Statistics.

To explore the linkages between the expansion of central bank balance sheets and foreign exchange rate regimes, we start by reviewing how the foreign exchange intervention activities of central banks affect the size of their balance sheets and how these activities alter the composition of central banks’ assets and liabilities.

Central bank assets and liabilities: the facts

How does the increase in foreign reserves affect a central bank balance sheet? A simplified central bank balance sheet is given in Table 1. Central bank assets consist of net foreign reserves and domestic assets; the liabilities comprise currency in circulation, bank reserves, deposits of other institutions (including government), the bank’s own securities and other liabilities and equity capital. Equity capital represents government transfers to the central bank (plus accumulated profits and losses). Without increased equity capital, the accumulation of assets requires financing in some form. The details of the expansion of Asian central bank balance sheets, in the range of both assets and liabilities, also offer insights into the policy choices of the monetary authorities.

Table 1
A central bank balance sheet

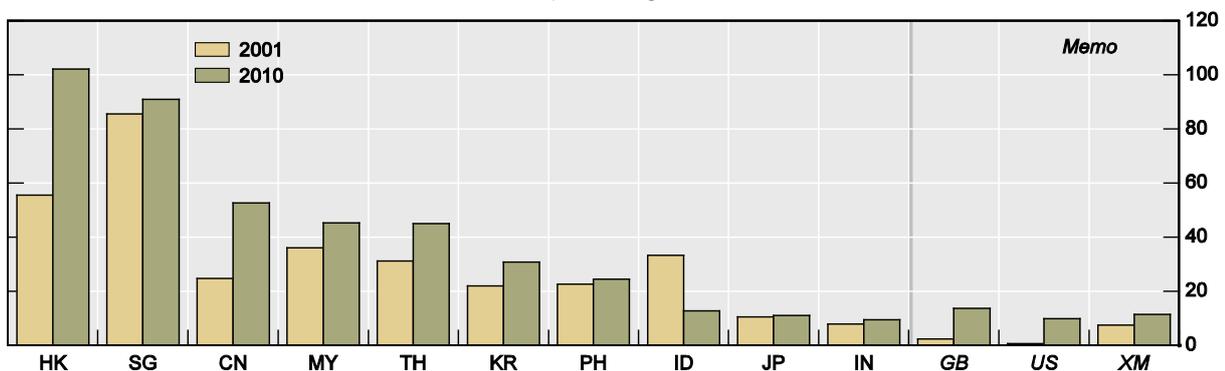
Assets	Liabilities and capital
Foreign assets	Reserve money
Domestic assets	Currency in circulation
Claims on government and public enterprises	Reserves of commercial banks
Claims on the private sector	Foreign liabilities
Claims on domestic money banks	Other deposits of commercial banks etc
Claims on other financial sector entities	Central bank securities etc
	Government deposits
	Others
	Equity capital

Assets

In emerging Asia, the increase in net foreign reserves has come to dominate the balance sheets of all the central banks. After a decade or more of these policies, the sheer magnitude of these foreign exchange reserve holdings now has macroeconomic implications for a number of countries in the region. Singapore and Hong Kong SAR, for example, each have reserves of around 100% of GDP; and China, Malaysia and Thailand have reserves equal to around half of GDP (Graph 4 and Table A2).

Table 2 provides a cross-country perspective on the assets on the balance sheet of the region's economies; Graph 5 illustrates quite vividly the dominant role foreign exchange assets has played in accounting for the cumulated *change* on the asset side of the central banks' balance sheet from 2002 to 2010. All other types of assets played a relatively small role in the expansion of emerging Asia's central bank balance sheets. Some view this behaviour as one-sided and as an attempt to keep exchange rates undervalued.

Graph 4
Central bank assets¹
As a percentage of GDP



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

¹ Net of currency in circulation.

Sources: IMF, International Financial Statistics; national data.

Yet the accumulation process was not continuous through the whole period. Some of the central banks experienced a sharp transient reduction during the international financial crisis (see Graph 1, right-hand panel).⁴ For example, the Bank of Korea shrank its balance sheet at the end of 2008 as did the Central Bank of Malaysia and the Reserve Bank of India. But these episodes were short-lived, as depreciation pressures rose: foreign assets still dominate the balance sheets.⁵ This underscores the point that, even though the run-up in foreign assets has been large and infrequently interrupted over the past decade, the region is open to running down assets when there are depreciation pressures. This supports the view that the intervention policy in emerging Asia should be seen as symmetrical but the shocks to the exchange rate have been one-sided. On this view, foreign reserve accumulation will eventually go into reverse naturally as appreciation pressures subside, although this process may take a considerable time.

Table 2
The composition of central bank assets¹
 As a percentage of total assets

	Foreign assets		Domestic assets; claims on							
			Government ²		Private sector		Banks ³		Others ⁴	
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
China	46.5	85.6	6.6	6.1	0.5	0.0	26.5	3.8	20.0	4.5
Hong Kong SAR	100.0	100.0	...	...	...	...	...	...	...	...
Indonesia	48.5	74.4	42.9	24.0	5.8	1.1	2.8	0.4	...	...
India	56.1	77.6	37.5	22.0	...	...	1.7	0.3	4.7	0.1
Korea	86.7	93.4	6.3	4.5	...	...	7.1	2.1	...	...
Malaysia	78.4	84.3	1.0	0.6	18.4	2.7	2.3	12.4	...	...
Philippines	74.1	87.5	18.1	8.7	2.8	2.7	5.1	1.1	...	...
Singapore	95.7	97.5	4.3	2.5	...	...	...	...	...	...
Thailand	73.2	94.3	6.2	5.4	18.4	0.0	2.2	0.2	...	...

¹ Data less than 0.04 is shown as 0.0; unavailable data is shown as '...'. ² Claims on government and public enterprises. ³ Deposit money banks. ⁴ Other financial sector entities.

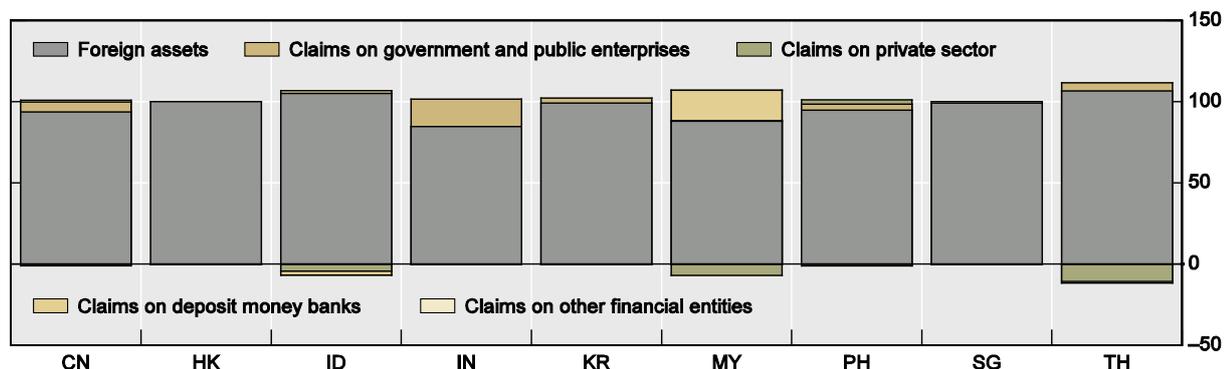
Sources: IMF, *International Financial Statistics*; national data.

⁴ In addition to reducing foreign currency assets on their balance sheet, many central banks reduced off-balance sheet foreign exchange claims. In some cases, the drawdown of net foreign exchange forward positions during the crisis was larger than the change in the on-balance sheet long foreign exchange positions (Graph A1).

⁵ The one exception in the 2000s is Japan and this illustrates the role of a central bank's balance sheet in addressing the liquidity needs of the general public and financial institutions. To meet this need, central banks have traditionally relied on open market purchases of securities. From the mid-1990s to the mid-2000s, the Bank of Japan tripled the size of its balance sheet from about 10% of GDP to 30% of GDP. This expansion reflected the extreme financial conditions that first led the central bank to adopt innovative policies in the form of the zero interest rate policy in 1999 and then quantitative easing in 2001. In particular, the quantitative easing programme aimed to support financial market functioning by targeting monetary policy operations at the level of outstanding current account balances of the private sector held at the Bank of Japan. These efforts were also augmented with what is now referred to as credit easing in the form of outright purchases of Japanese government bonds, purchases of asset-backed securities and asset-backed commercial paper, commercial paper repos and equity purchases from financial institutions. While contracting somewhat since the mid-2000s, the Bank of Japan's balance sheet measured in relation to GDP is comparable to that of the Federal Reserve (not including the likely increase in size associated with the latest large-scale asset purchase programme) and larger than those of the ECB and Bank of England.

Graph 5
Change in composition of central bank assets in Asia, 2002–10

As a percentage of change in total assets



CN = China; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand.

Source: IMF, International Financial Statistics.

Liabilities

For completeness, it is useful to review the structure of the liabilities side of the balance sheet. The liability side provides a glimpse into the choice of central bank policy instruments used to sterilise the impact of the foreign exchange intervention. Across the region, central banks have looked to various instruments to drain the additional liquidity that is pumped into the economy as central banks buy foreign exchange.

Table 3
Composition of central bank liabilities¹

As a percentage of total assets

	Reserves of commercial banks ²		Deposits of commercial banks		Central bank bonds		Government deposits		Others ³	
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
China	56.5	55.9	...	0.3	...	16.1	6.7	9.6	-2.0	-0.3
Hong Kong SAR	15.6	40.3	...	...	...	...	46.3	29.1	-16.1	-9.2
Indonesia	14.3	17.8	8.9	32.3	...	5.4	14.9	7.9	8.5	1.3
India	20.5	22.5	...	...	...	...	0.0	5.7	20.3	17.4
Korea	8.7	10.4	0.0	0.0	57.4	47.9	4.5	1.7	0.6	26.1
Malaysia	9.8	1.4	38.1	60.1	...	...	16.9	3.7	1.1	0.8
Philippines	7.2	16.6	10.2	50.3	...	...	7.9	3.5	1.5	0.4
Singapore	5.6	6.1	...	...	...	...	58.2	44.0	27.1	41.0
Thailand	2.6	1.6	10.9	41.7	5.5	21.3	1.4	7.3	-20.8	0.0

¹ Data less than 0.04 is shown as 0.0; unavailable data is shown as '...'. ² Reserves money other than currency in circulation. ³ Including loans and other items (net).

Source: IMF, International Financial Statistics.

Given the various options, it is not surprising that the impact of the expansion of liabilities side of Asian central bank balance sheets has been more diverse than that of the assets side (Table 3 and Graph 6). Currency and reserve money have risen sharply across most of the region, reflecting the strong underlying economic growth in Asian economies. The rise in

reserve money also reflects the growth in commercial bank deposits at the central bank. In part, this reflects financial system deepening; it also suggests that commercial banks could put the funds to no better use. In addition, several central banks have raised reserve requirements to curb the growth in bank lending. Greater issuance of central bank paper (eg in China and Indonesia) and the use of deposit facilities at central banks also show up significantly. Changes in government deposits are important sources of change in some economies, reflecting both the traditional mandate of central banks as the government's banker and the use of government deposits as a means to sterilise foreign exchange intervention.

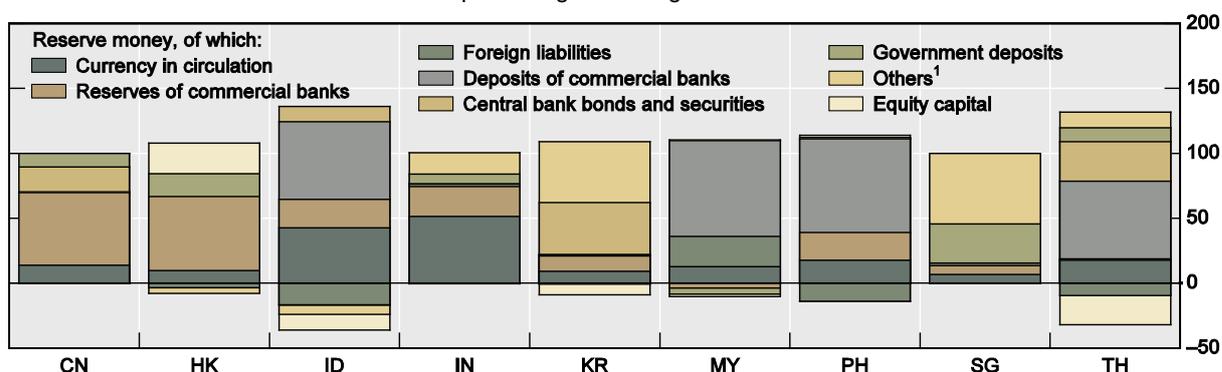
The decade in retrospect

Overall, the period following the Asian crisis has been one of successful policymaking for the central banks of the region. Inflation has remained fairly low and stable, and growth has been strong. Financial stability concerns, while present as financial liberalisation continued apace, did not materialise to the extent seen in the West. It is important to note that central banks do not as a rule face any *technical* difficulty in funding the expansion of their balance sheets (when they intervene, they issue a liability which is usually acceptable in the market). Given this record, one might be tempted to conclude that the rapid expansion of central bank balance sheets via foreign exchange reserve accumulation is relatively benign.

However, such a conclusion may be premature. A number of risks may yet prove disruptive as balance sheets continue to expand. On the macroeconomic side, questions remain about the inflationary implications of a large increase in reserve (base) money. On the financial side, questions remain about whether the liabilities that central banks use to fund the purchase of foreign reserve assets can lead to greater elasticity of the credit supply from banks. In addition, concerns exist that expansion of "other liabilities" (not technically part of reserve money) could crowd out other asset holdings in the financial intermediation process. On the central bank balance sheet management side, does the huge currency mismatch between the asset and liability sides of the central banks' balance sheets raise concerns? This paper explores these issues. To a great extent, the answers to these questions are inextricably linked to the choice of exchange rate regimes in the region. We turn to this topic in the next section.

Graph 6
Change in composition of central bank liabilities in Asia, 2002–10

As a percentage of change in total assets



CN = China; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand.

¹ Including loans and other items (net).

Source: IMF, International Financial Statistics.

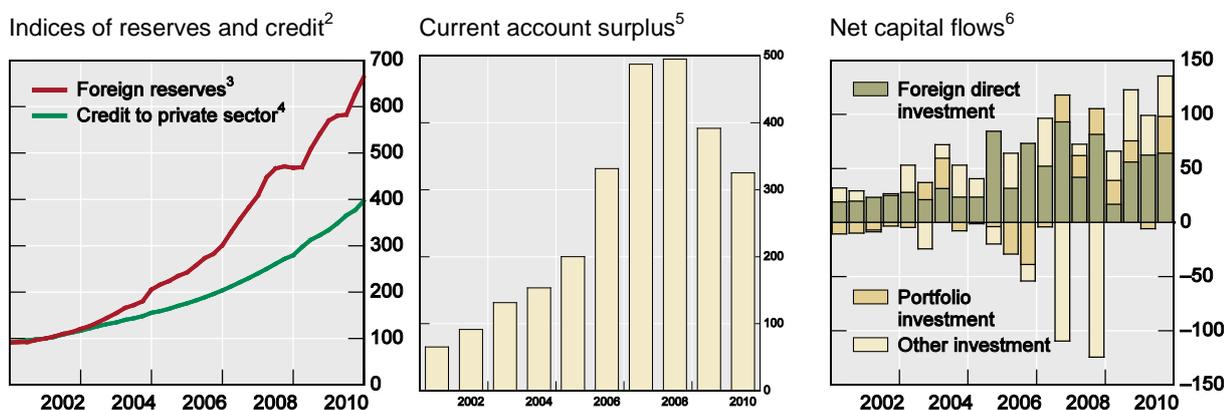
II. Money, credit, the Impossible Trinity and central bank balance sheets: lessons learnt and policy challenges ahead

Two main arguments for free floating were heard after the Asian financial crisis. First, proponents of the “corner solutions” view argued that the middle ground of managed exchange rates was untenable. Countries had to adopt hard fixes or free floats. Second, a more general version of this argument was contained in the Impossible Trinity doctrine: countries open to international capital flows could choose a fixed exchange rate or an independent domestic monetary policy, but not both (Calvo (1991), Aizenman (2010)). The concern was that intermediate exchange rate regimes in emerging market economies ran the risk of excessive reserve money and credit creation, raising the spectres of inflation and financial instability.

At first sight, this seems a familiar story to observers of Asia over the past decade. In the region, the fourfold increase in foreign exchange reserves in the seven years shown was accompanied by a three-fold increase in credit (Graph 7). It might seem that these substantial increases were related, as the Impossible Trinity hypothesis would suggest.

However, the apparent link to the doctrine is weaker than at first meets the eye. In the rest of this section, we explore the empirical links from foreign reserve accumulation to money and credit during the past decade. As we shall see, even with the huge increase in foreign exchange reserves, the rise in reserve money was modest (weakening the direct link between foreign reserve increase and credit) and inflation remained well contained. For credit, the supporting evidence is somewhat more favourable to the Impossible Trinity doctrine but, in the end, argues for a new way of thinking about the linkages among foreign reserve accumulation, central bank balance sheets and macroeconomic/financial stability.

Graph 7
Foreign reserves, credit and capital flows in Asia¹



1 China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. ² End-2001 = 100. ³ In US dollar terms; sum of the economies listed. ⁴ Weighted average based on 2005 GDP and PPP exchange rates. ⁵ In billions of US dollars; sum of economies listed. ⁶ Positive (negative) indicates inflows (outflows).

Source: IMF, International Financial Statistics.

Central bank balance sheet expansion, money and inflation: the elusive nexus

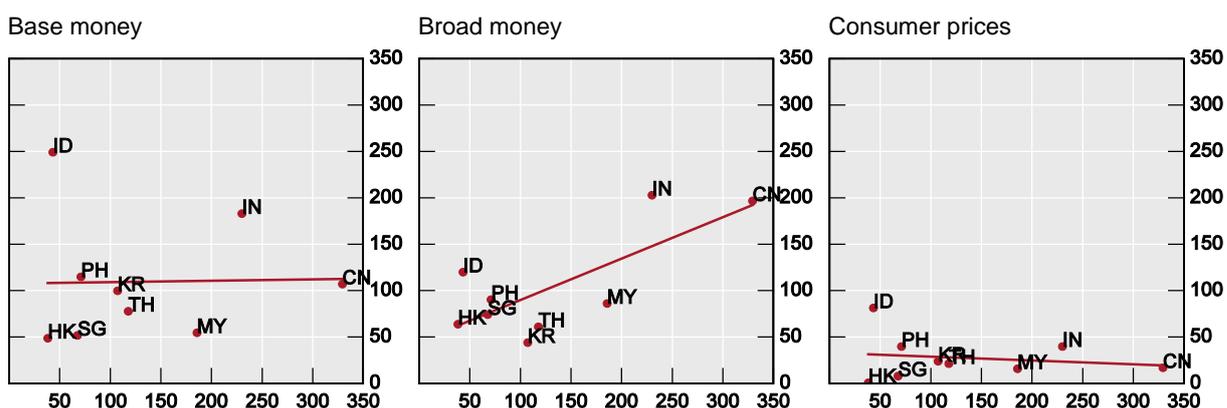
The Impossible Trinity view envisaged that, if countries attempted to prevent their exchange rates from appreciating, current accounts would move into surplus and foreign exchange reserves would rise. This would boost reserve money and bring about credit expansion, stronger economic activity and inflation, lifting the real exchange rate and eroding international competitiveness. The prospect of this adjustment would also attract foreign

capital inflows, further boosting foreign exchange reserves and reserve money. Any attempt to respond to inflationary pressures by raising interest rates would prove counterproductive, encouraging even more capital inflows.⁶

Graph 8 illustrates quite convincingly that the transmission mechanism from foreign exchange asset accumulation to reserve money growth to inflation did not function in emerging Asia during much of the 2000s. The correlation between the growth in central bank assets and reserve money was virtually zero:⁷ in the centre panel of Graph 8, the broad monetary aggregates show some tendency to be positively related but, on close inspection, the slope of the line turns out to be largely determined by the observations for China and India. Finally, the correlation with inflation is, if anything, modestly negative.

Overall, these results are consistent with the findings of Aizenman et al (2008) – emerging Asian economies have been able to adopt intermediate exchange rate regimes (ie managed floats) while retaining some degree of monetary autonomy, even as greater financial openness was achieved. Sizeable international reserves have been a critical part of the success of this approach. In other words, the direct monetary effect on inflation of the increase in foreign exchange reserves was effectively sterilised in most countries.

Graph 8
Growth of central bank assets relative to the growth of money and consumer prices¹
 2001–07; in per cent



¹ The horizontal axis shows the change in central bank total assets; the vertical axis represents the change in the variables shown in the panel title.

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

Defying the Impossible Trinity: evolving views on the monetary transmission mechanism

How did these emerging Asian economies avoid the apparently inexorable forces of the Impossible Trinity, and successfully take the supposedly untenable middle ground of the “corner solutions” argument?⁸

In a nutshell, the key monetary transmission mechanism envisaged in the Impossible Trinity did not function. In other words, the rise in foreign exchange reserves did not cause reserve

⁶ It was assumed that foreign and domestic assets were close substitutes in this integrated world, so that there would be large inflows in response to even minor interest differentials.

⁷ The correlations with net foreign assets are similar; see Graphs A2 and A3 in the Annex.

⁸ Others who have looked at these issues in recent years include BIS (2009) and Aizenman and Glick (2009).

money to rise and the credit multiplier process to operate. In retrospect, maybe this should not come as a big surprise. This traditional transmission channel belongs to an earlier era where monetary policy was implemented via control over reserve money, with the growth of credit set via the credit multiplier. In that world, monetary policy operates by restricting the *supply of reserve funds* to the banking system.

Today, this monetary transmission mechanism is much less relevant, even in the emerging market economies. Central banks generally use interest rates as the policy instrument. In other words, central banks set policy interest rates and supply financial markets with the liquidity they want at that price. This has important implications for a central bank's balance sheet when sterilising the accumulation of foreign exchange sterilisation operations. In theory, any increase in domestic liquidity that is not consistent with the policy interest rate setting will flow back to the central bank via domestic liquidity management. In other words, central banks generally, and virtually automatically, sterilise any excess liquidity supplied through foreign exchange intervention.⁹

The developments on the liability side of central bank balance sheets (see Table 3 and Graph 6) illustrate this tendency, as central banks chose various means at their disposal to fund their expanding foreign asset holdings. For all these countries, strong underlying growth in activity raised the public's demand for currency, providing a source of zero interest rate funding. The extent of this currency funding was, of course, determined by the public's demand for currency, and was not under the direct control of the central bank. This funding source was especially important for India and Indonesia.

More widely apparent was the rise in the other element of reserve money – banks' deposits at the central bank. Some of this reflected the normal rise in the demand for bank reserves as the financial sector grows and broadens. It also reflects the reliance of some Asian central banks on the use of the required reserves in their monetary policy frameworks (eg Ma et al (2011) and Montoro and Moreno (2011)). For some Asian central banks, this instrument had become unfashionable during the shift towards a more market-oriented deregulatory approach. More recently, interest in required reserves has revived as a way to help neutralise the build-up of reserve money and short-term liquidity without resorting to policy rate increases.¹⁰

The past decade has seen two important technical developments on the liability side of central bank balance sheets. First, central banks have increasingly issued their own securities. This represents a powerful sterilisation tool. None of the central banks in our sample had enough domestic government securities on their balance sheets to run these down in open market operations – the conventional text-book liquidity-reducing practice. Thus their ability to issue sterilisation instruments has been a key element of the sterilisation story. Bank Indonesia has issued SBI for this purpose since the 1980s and central bank bonds also have a long history in Korea, but other central banks came to use them extensively only in the 2000s. Thailand's capacity to issue was progressively enlarged during the past decade; the PBC began issuing its own paper in 2003; and Malaysia's capacity to use this instrument was greatly enhanced with new legislation in 2006.¹¹

⁹ It is technically relatively easy for the authorities to manage the liquidity requirements of the financial system provided the central bank has suitable instruments for sterilisation, such as the ability to issue its own bonds. The central bank's foreign exchange intervention leaves the banks with excess liquidity, so that there is a ready demand for these stabilisation instruments from the commercial banks.

¹⁰ In addition, it has also have been justified in prudential terms, although the degree to which it has been used exceeds any prudential requirement. China, India, and the Philippines have all relied on this approach. Substantial reserve requirements distort financial intermediation by levying what amounts to a tax on the banking system. Nevertheless it is attractive as a low-cost (sometimes zero-cost) source of funding.

¹¹ See Glick and Hutchinson (2008) and Mehrotra (2011, forthcoming).

The other important innovation was the payment of interest on excess reserves held at the central bank.¹² This facility was put in place in Malaysia in 2004, Singapore in 2006 and Thailand in 2007 (see Ho (2008)). These two sterilisation innovations broadened the array of market-oriented sterilisation instruments and allowed central banks to avoid reliance on less market-friendly measures such as increases in required reserves. Thus the technical means of sterilisation have been substantially strengthened over the past decade. Where reserve money was not directly sterilised, the commercial banks were offered an incentive (in the form of interest paid on deposits held with the central bank) to go on holding excess reserves, rather than expand their balance sheets through lending.

Another powerful channel of sterilisation is not usually found in the textbooks. Both India and Singapore issue government securities (“overfunding the budget”), and place the cash counterpart of the issue on deposit at the monetary authority: these funds formed the bulk of the sterilisation funding in Singapore and were an important recent (2004) innovation in India. This underscores the importance of the interactions between central bank balance sheet management and sovereign debt management, a topic that has attracted particular attention recently (eg Turner (2011)).

Additional implications

Of course, this may not be the end of the story, even for countries where sterilisation seems fairly complete. The sterilisation process often involves changes in the composition of balance sheets of both central banks and commercial banks. Growth in central bank liabilities leads to growth in the balance sheets of commercial banks which might, in turn, affect their incentives for lending. In other words, as central banks sterilise foreign exchange interventions, they alter the bank lending channel and increase the incentive to expand credit.¹³ For example, when sterilisation takes the form of central bank or government securities, the banks take highly liquid securities onto their balance sheets. This could at a later date be the basis for further expansion of their balance sheets if the banks choose to leverage up on this relatively safe asset by expanding credit to the private sector.¹⁴

¹² It had been a key element of the credit multiplier story that reserves were unremunerated. This discouraged banks from holding excess reserves and thus gave the central bank leverage to restrain the commercial banks' balance sheets when necessary.

¹³ Before addressing that question, we might also ask whether loading up the asset side of the banks' balance sheets with central bank paper might, in fact, have had the opposite effect of crowding out other lending – as banks would have little incentive to expand their balance sheets through increased lending if they could instead hold this high-quality paper. It seems unlikely, however, that the sterilisation bonds crowded out credit growth that would otherwise have occurred. The initial source of the foreign exchange reserve increase added to the funding side (deposits) of the banks' balance sheets. If the source of the upward pressure on the exchange rate was a current account surplus, the net export earnings created bank deposits, at least initially. In macro terms, there was a positive savings/investment balance that was available to fund the reserve build-up. In the case of foreign capital inflows, the foreigners initially sold their foreign exchange to a commercial bank which sold it to the central bank. The commercial bank gained additional deposits and held the central bank sterilisation bond. Of course this is not the end of the story, but it suggests that the commercial banks can fund their holdings of sterilisation securities without crowding out their lending. There is the interesting case where the sterilisation bonds are sold to the non-bank public. The new purchaser pays by running down a deposit, which would, at least initially, shrink both sides of the commercial bank's balance sheet, but leave loans untouched.

¹⁴ There would be no effects only in the case where the exporters/foreigners held all the sterilisation bonds. But if the foreigners want to hold other assets, relative prices will have to change to facilitate these shifts in asset holding, and these relative price changes may well affect credit growth. While foreigners didn't hold *all* the sterilisation bonds, they did hold some: in Indonesia, for example, foreigners hold nearly 30% of SBIs (Bank Indonesia's sterilisation instrument) and government securities.

In the absence of the traditional credit multiplier process, effects via *relative price changes* are possible within the financial sector. Relative price changes might alter banks' funding costs (and their lending margins), and their cost of raising capital (Borio and Zhu (2008) and Disyatat (2010)). While such changes no doubt have occurred, these are such subtle influences that they could be hard to disentangle from large changes in bank margins caused, for example, by the stickiness of lending rates in response to changes in the policy rate (which have been found to be on the order of 200–300 basis point changes in bank margins over the course of the business cycle in some cases).

Central bank balance sheet, credit, asset prices and financial stability

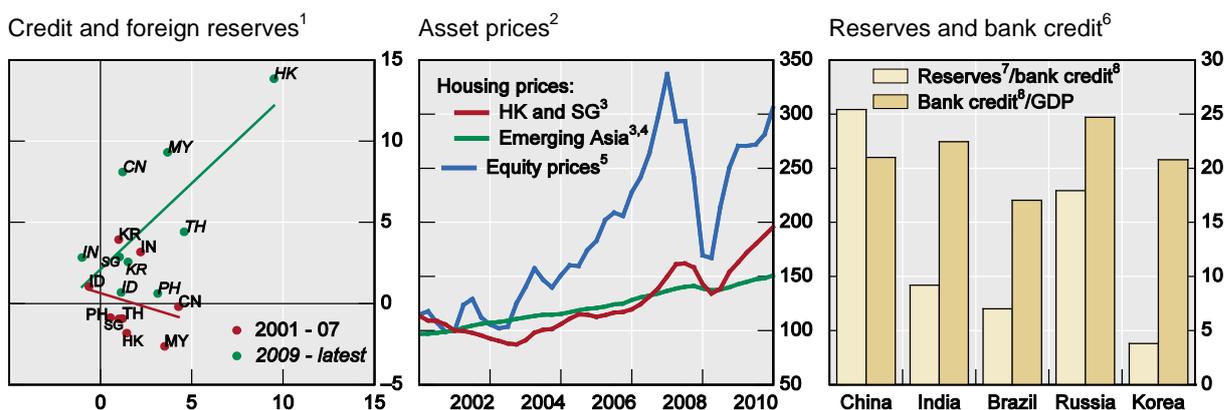
Perhaps surprisingly, given the growth in the aggregate credit data shown in Graph 7, when credit growth as a percentage of GDP is examined country by country, the picture is not particularly clear that the region's credit growth has been a persistent problem in a way that would suggest a systematic build-up of financial imbalances. In the first part of the 2000s, only two economies (Korea and India) show substantial growth (Graph 9). Korea, in particular, has seen a credit card boom gone bad during this period, and property price bubbles were a policy concern. Most of the other countries show credit expanding not much faster than nominal GDP.

Moreover, we cannot rule out special factors that could account for part of the rapid credit growth in these two economies. They began the decade with an unusually low level of credit to GDP, by international norms. For Korea, one element of the story is that businesses obtain a substantial part of their funding from sources other than the domestic banking system. But even with this caveat, the fast credit growth in both these countries can be partly explained in terms of the transition towards a normal level of bank intermediation. This, of course, still raises important policy issues about the speed of transition, the dangers inherent in the transition process and the problem of identifying when the transition has run its course. These judgements are difficult because credit has to grow faster than GDP in order to achieve a new normal.¹⁵

However, recent trends suggest the relatively benign assessment for the earlier part of the decade may be too favourable. Since the business cycle trough in early 2009, credit growth in the region has been surging as has foreign reserve accumulation (Graph 9, left-hand panel). China, Malaysia, Hong Kong and Thailand stand out in this respect. At the same time, this surge in credit creation and foreign reserve accumulation has corresponded with robust growth in housing and equity prices (centre panel, Graph 9).

¹⁵ In several of these countries (notably Korea and Indonesia), one of the legacies of the Asian financial crisis was that bank lending to corporations and businesses fell away (for both demand and supply reasons) and banks saw households as more bankable customers. As a result, there are policy issues in Korea relating to the growth and extent of household debt (eg Chung (2009)). Household debt grew from one quarter of total lending in 1999 to nearly one half by 2002. This took household debt from 50% of GDP to over 70%, and as a percentage of household disposable income, it rose from 80% to 130%. Since then it has levelled out as a percentage of GDP and household income. The same trends can be seen in Malaysia: banks' loans to households grew from one third of total loans in 1997 to 56% in 2007 (Endut and Hua (2009)). In Thailand, the ratio of debt to household income rose from 40% in 1998 to 58% in 2004 (Subhanij (2009)). The focus here, however, is on the development of the overall credit aggregates.

Graph 9
Foreign reserves, credit and asset prices



1 Horizontal axis shows foreign reserves as percentage of GDP; the vertical axis represents credit to the private sector as percentage of GDP; annual average change in the ratios. 2 End-2001 = 100. 3 Weighted average based on 2005 GDP and PPP exchange rates. 4 China, Hong Kong SAR, Indonesia, Korea, Malaysia, Singapore and Thailand. 5 MSCI emerging Asia in local currency. 6 Increase, in percentage points; end-2002, latest available data. 7 Foreign exchange reserves minus currency in circulation. 8 Bank credit to the private sector.

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

The elasticity of lending *capacity* and financial stability concerns

Is it possible that the decade of rapid foreign reserve accumulation has contributed to a surge in lending activities and that vulnerabilities of the financial systems in Asia will be exposed?¹⁶ In other words, did the increase in liquid assets associated with sterilisation operations help to shape this environment of rapid credit growth?¹⁷

One view is that the growth of credit during most of the decade has been determined largely by demand rather than by the availability of funding via sterilisation operations. In most Asian economies (eg Indonesia, Korea, Malaysia, the Philippines, Thailand, Hong Kong SAR and Singapore), commercial banks continuously held substantial excess reserve money and stabilisation instruments on their balance sheets. If they had expanded their balance sheets in the way envisaged by the traditional credit multiplier process, these holdings would have been taken up in the form of additions to required reserves and public currency holdings, as credit growth pushed well beyond the growth of nominal GDP.

¹⁶ Here we can see an important distinction between sterilisation by means of issuing central bank paper, and sterilisation via increased reserve requirements. The former, while more market-friendly, gives commercial banks the funding liquidity that would allow them to expand their lending, should they decide to do so, while the cruder instrument of reserve requirements exercises a more direct restraint on banks' balance sheet expansion. The large volume of "lazy assets" (in the form of low-yield sterilisation bonds) on the balance sheets of the banks in five of the countries in this group provides the funding by which these banks could expand credit. Where banks have no room to profitably increase their lending, they are captive holders of these instruments, and the authorities can use this fact to cut the interest rate on these instruments, thus reducing the cost of their sterilisation operations. But such a strategy will give banks greater incentives to find new lending opportunities. Over time, pressure will build to replace these low-return assets with high-earning loan assets. The presence of these low-risk assets may encourage banks to take on higher-risk alternative assets (offering loans to customers previously considered to be not bankable). To keep these instruments "bedded down", the authorities have to offer a full market return, and this makes the sterilisation operation more expensive. Even where the instruments offer the full policy rate, there is often a substantial margin between the policy rate and the lending rate, providing incentives to replace the sterilisation instruments with loans.

¹⁷ For a detailed discussion of these issues, see Mohanty and Turner (2006).

Another view would argue that these vulnerabilities were largely dormant during much of the 2000s but nonetheless grew. Indeed, we cannot exclude the possibility (even likelihood) that *some* of the rapid credit growth that was seen at times arose from the elastic supply of bank lending. Again, Korea's experience points in this direction. By and large, however, most of the liquidity associated with the foreign exchange intervention appears to have found a home in the form of currency or required reserves. The situation now seems more worrisome.

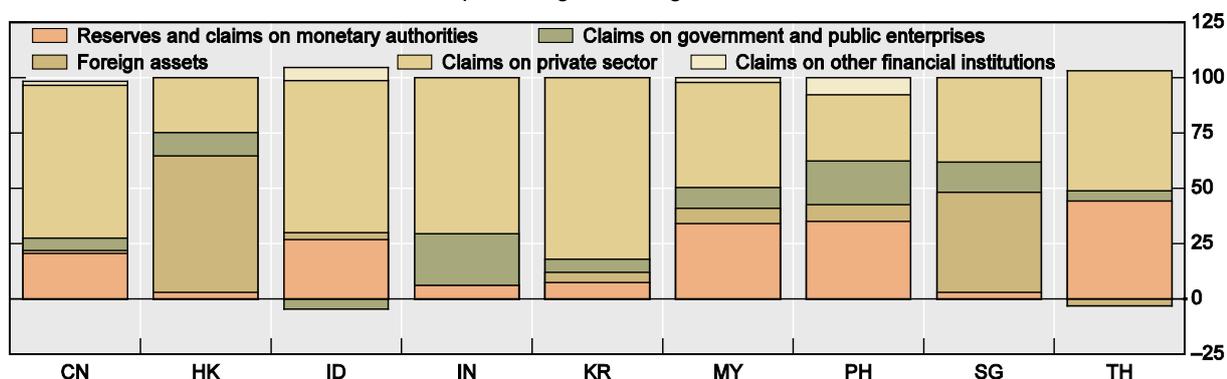
The critical question is whether this increased elasticity of the credit supply can quickly lead to unstable financial conditions that promote excess credit expansion, rapid asset price growth and eventually financial instability.

The concerns associated with this view have already taken on considerable importance given the state of Asian commercial bank balance sheets. Graph 10 shows that commercial banks in all these economies (with the possible exception of China) have accumulated substantial holdings of near-reserve-money instruments: central bank or government paper, or foreign currency.

Moreover, Graph 11 underscores the potential lending elasticity of Asian financial systems even under the new financial regulatory regime being put in place internationally. It shows that capital reserves of the Asian banking systems are well in excess of the Basel requirements (ie Asian banks on the whole are not particularly capital constrained),¹⁸ and that for all, except for Korea and perhaps Thailand, the loan/deposit ratio suggests that bank lending is not constrained by a shortage of deposit funding.

Graph 10
Change in assets of deposit money banks, 2002–10

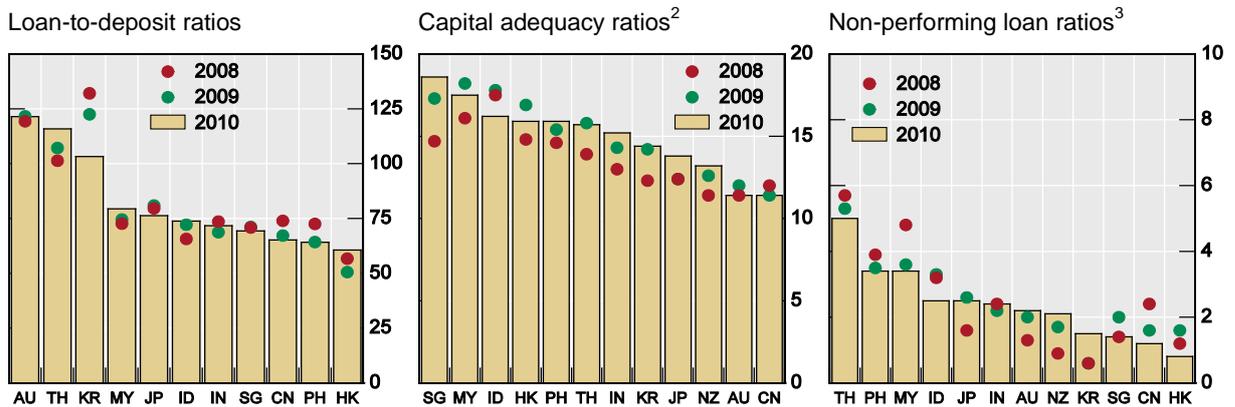
As a percentage of change in total assets



Source: IMF, International Financial Statistics.

¹⁸ The one exception is China in 2006.

Graph 11
Bank soundness indicators¹



AU = Australia; CN = China; HK = Hong Kong SAR; IN = India; ID = Indonesia; JP = Japan; KR = Korea; MY = Malaysia; NZ = New Zealand; PH = Philippines; SG = Singapore; TH = Thailand.

¹ In percent. ² Total capital as a percentage of total risk-weighted assets. ³ Definitions may vary across countries.

Sources: IMF; Bloomberg; CEIC; national data.

Some tentative lessons learnt: four aspects of the policy trade-offs in this environment

The demise of the bipolar view associated with the canonical Impossible Trinity doctrine begs the question of what replaces it. Here we offer four important aspects of an environment in which the constraints of the Trilemma are relaxed. Though not mutually exclusive, they provide a more empirically appealing way to think about the policy trade-offs facing Asian central banks. First, foreign reserve asset accumulation may be an effective, though partially, independent policy tool. Second, macroprudential policy tools and capital flow management tools offer effective ways to constrain excessive money and credit growth. For these two possibilities, questions arise about whether they can be effective beyond the short term. Third, the greater use of monetary conditions indexes (MCIs) in the formulation of monetary policy may be warranted. Fourth, the active foreign exchange intervention implicit in intermediate exchange rate regimes may pose more significant macroeconomic-financial stability risks than have been experienced in the past decade.

1. Foreign exchange reserve accumulation: a partially independent policy tool

The Asian experience suggests that central banks in the region can intervene in the foreign exchange market and resist nominal appreciation pressures while at the same time liberalising financial markets and retaining some degree of central bank independence for considerable periods of time. In other words, foreign exchange rate intervention seems to have had some success in influencing exchange rates without sacrificing the ability of credible, low-inflation monetary policy frameworks to deliver price stability.

It is worth noting that inflation did pick up in 2008 and again recently. As in Aizenman (2010), this may suggest that while the accumulation of foreign reserves may loosen some of the constraints of the Impossible Trinity doctrine in the short term, but there are limits. Establishing those limits in practice for both price stability and financial stability may prove to be quite difficult.

2. Monetary policy is not alone: factoring in other policy tools that can constrain credit growth

One might argue that monetary policy was kept relatively accommodative over the past decade while macroprudential tools, as they are now termed, were successfully used to rein in credit. Graph 12 suggests that, judged by the real policy rate, the policy stance has been

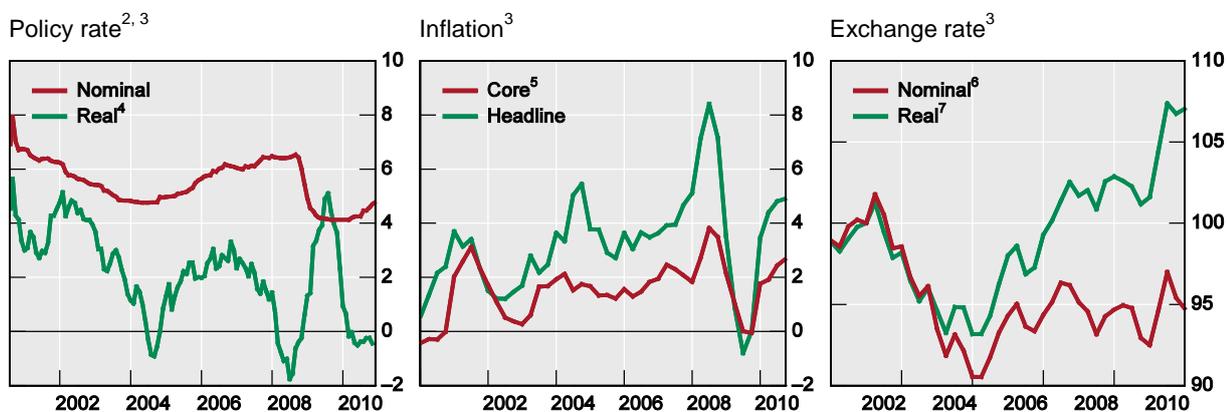
generally accommodative in recent years. This is consistent with the view that relatively conservative financial system practices were adopted in the aftermath of the Asian financial crisis in the late 1990s and that this was sufficient during much of the decade to ward off the financial instability associated with rapid credit and asset price growth.

Why did policymakers choose to keep policy rates relatively accommodative and rely more heavily on non-price policy tools? Two possible explanations relate to the choice of exchange rate regime. First, authorities may have been concerned about disruptive capital inflows. A risk often mentioned by Asian central bankers in recent years is that higher interest rates would attract even larger foreign inflows, intensifying upward pressure on the exchange rate and also exposing their economies to the risk of a sudden and disruptive stop of capital flows at a later stage. Second, some central banks have argued that a real appreciation of the exchange rate would eventually achieve the external restraint in a less costly manner than would appreciation of the nominal exchange rate. The latter argument has taken on greater force in 2010–11.

Whatever the case, one view argues that macroprudential policy tools and capital flow management tools can effectively relax the constraints of the Trilemma. But can they do so over the medium and long term? The jury is still out but recent developments suggest that such tools can only buy time and are not effective substitutes over the longer term. The continued frothiness in property markets in Hong Kong SAR and Singapore underscores the limitations of macroprudential tools in fine-tuning the relationship between credit supply and credit demand.

Graph 12
Monetary policy and central bank balance sheets in emerging Asia¹

In per cent / index



¹ China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. ² For China, one-year lending rate; for Hong Kong SAR, base rate; for India, reverse repo rate; for Indonesia, one-month SBI rate; for Korea, overnight call rate; for Malaysia, overnight policy rate; for the Philippines, overnight reserve repo rate; for Singapore, three-month interbank offered rate; for Thailand, 14-day repo rate before 17 January 2007, overnight repo rate thereafter. ³ Weighted average of listed economies based on 2005 GDP and PPP exchange rates. ⁴ Policy rates or their proxies minus 12-month change in CPI. ⁵ Headline inflation excluding food and energy. ⁶ Nominal effective exchange rate; an increase indicates an appreciation. ⁷ Real effective exchange rate; an increase indicates an appreciation.

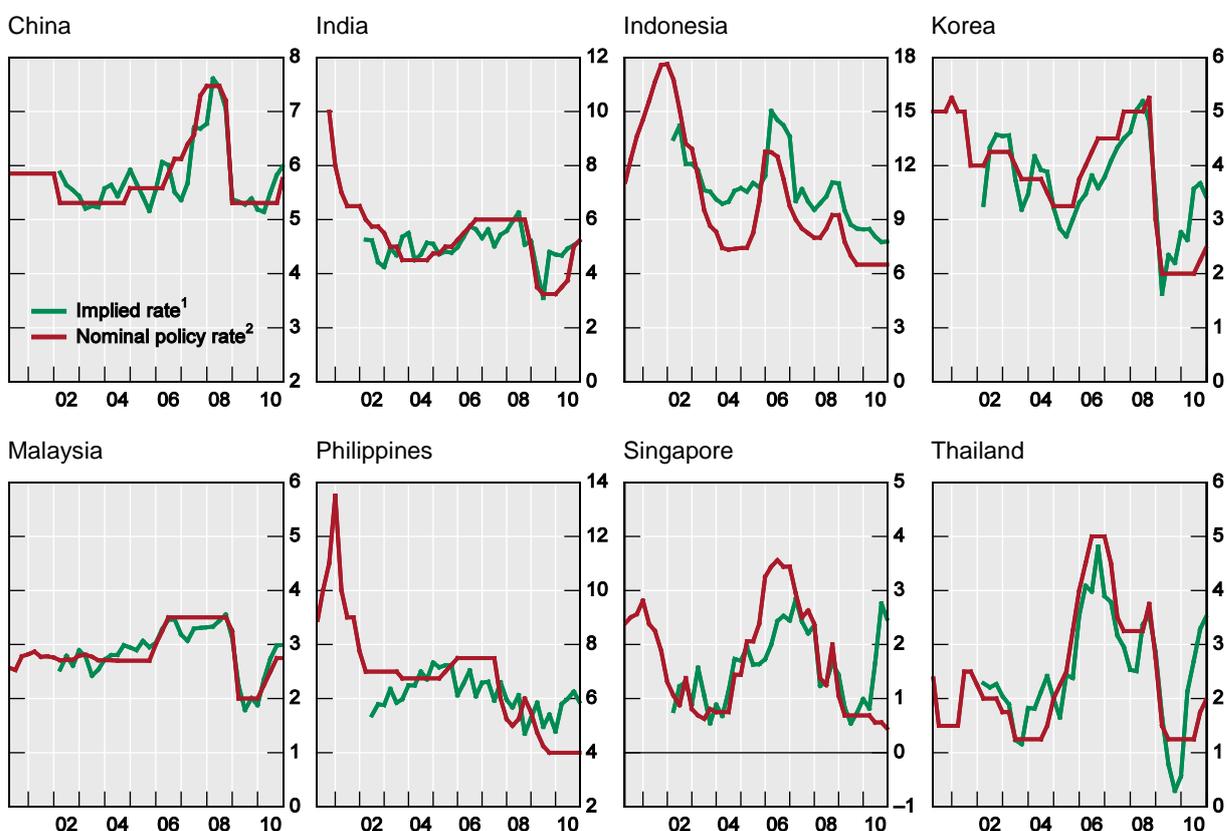
Sources: Bloomberg; CEIC; BIS; national data.

3. *The stance of monetary policy and the return of the MCI*

Some years ago, it was common practice to assess the monetary policy stance in terms of a Monetary Conditions Index (MCI) that combined both the level of interest rates and the exchange rate. The rationale was that, if the market had pushed up the exchange rate, this appreciation would restrain both domestic demand and prices, so that a lower interest rate would be consistent with the same policy stance. The use of the MCI has since become less

common, as it came to be recognised that the MCI can give misleading signals on the appropriate policy stance when the terms of trade change.¹⁹

Graph 13
Policy rates and those implied by the Taylor Rule
 In per cent



¹ Fitted values of model $R_t = a + b(p_{t-1} - p_{t-1}^T) - g(y_{t-1} - y_{t-1}^*) + \eta f_t + h f_{t-1} + e_t$, excluding the period Q1 2008–Q3 2009 and previous crises. R is the nominal policy rate; π is the headline inflation rate; π^T is the inflation target for inflation targeting countries; the five-year moving average of headline inflation is taken to be a proxy for the inflation objective in the other economies; y is output; y^* is the output trend estimated with a Hodrick-Prescott filter (smoothing parameter 1,600); f is the year-on-year nominal effective exchange rate change. ² For China, one-year lending rate; for India, reverse repo rate; for Indonesia, one-month SBI rate; for Korea, overnight call rate; for Malaysia, overnight policy rate; for the Philippines, overnight reserve repo rate; for Singapore, three-month interbank rate; for Thailand, 14-day repo rate before 17 January 2007; overnight repo thereafter.

Sources: © Consensus Economics, Bloomberg; Datastream, national data.

In fact it may be useful to bring this MCI idea (with its prominent role for the exchange rate) back from the wilderness when assessing whether recent monetary policy has been appropriately set. Graph 13 summarises the results of a Taylor Rule regression which incorporates the exchange rate both as a policy objective (on the right-hand side of the equation) and as a policy instrument (on the left-hand side of the equation).

¹⁹ If the exchange rate appreciation reflects stronger terms of trade (eg higher export commodity prices), it would not be appropriate to lower interest rates in order to keep the MCI stable. A higher MCI would be appropriate, and policymakers still have to make this judgment. Similarly, when the market delivers a lower exchange rate, it is not always appropriate to keep the MCI constant by raising interest rates.

Of course, such Taylor Rule estimations only show how policy at a particular point of time compares with what it would have been if the authorities had responded to the objectives in the way they have done on average over the estimation period. But it suggests that, for most of these countries, recent policy settings as measured by an MCI are quite accommodative.

4. *Macrofinancial risks arising from possible misperceptions*

The choice of an intermediate exchange rate regime requires greater reliance on foreign exchange intervention both on the upside and the downside of the exchange rate pressure cycle. In the past decade, the appreciation pressures in Asia were symptomatic of emerging market economies experiencing strong economic growth. If the shocks hitting these economies are largely permanent, potential output grows quickly, and this calls for considerable credit expansion to finance the increased activity. This situation is consistent with an upward trend in private credit in the 2000s (see Graph 7).

A more worrisome situation could arise if the supply shocks are thought to be permanent but prove to be transient. In this case, a pickup in productivity growth would draw in capital flows, boosting bank lending and aggregate supply. The resulting growth in supply would help to hold down goods and services prices while, at the same time, lifting equity and housing prices. All this would tend to confirm a view that the potential growth of the economy was on a higher trajectory in the short term. However, if this higher trajectory is transient and disappoints expectations, the additional credit growth and associated investment could prove to be excessive. Depending on the extent of the excess, this credit cycle gone bad could lead to a collapse of confidence, a recession and a sudden end to capital flows.

All this suggests that correlations between foreign exchange intervention and credit need not suggest imperfect sterilisation. The correlations could simply reflect a tendency for policymakers to assume that “this time it is different” and to put too much weight on the possibility that a run of good outturns is symptomatic of a permanently new trajectory for economic activity. Over the whole cycle, which admittedly can be long in the case of emerging market economies, this could lead to excessive debt accumulation by both domestic agents and foreign investors, all of which may end badly. Emerging Asian economies should remain vigilant against this possibility.²⁰

III. The costs of holding foreign exchange reserves in Asia

In the previous section, it was argued that policy can both influence the exchange rate to some degree and, at the same time, maintain an independent monetary policy. Even if feasible, though, is this a good idea? One important consideration in this decision is the cost of holding these very large investments in foreign reserves. In other words, can the continued expansion be justified in terms of the costs and benefits? Arguably, these costs will play an increasingly important role in determining when to stop accumulating, or when it would be appropriate to reverse current trends.²¹

²⁰ As Reinhart and Rogoff (2009) remind us, “Policymakers should not have been overly cheered by the absence of major external sovereign defaults from 2003 to 2009 after the wave of defaults in the preceding two decades. Serial default remains the norm, with international waves of defaults typically separated by many years, if not decades.”

²¹ While central banks in the western world have typically seen domestic assets rising over time, the Swiss National Bank is an exception. In recent years, it has intervened in its foreign exchange markets and has amassed a large quantity of foreign exchange reserves. Danthine (2011) stresses that the losses associated with holding such reserves should be evaluated over the whole risk cycle. Nonetheless, significant short-term losses can raise questions about the appropriate degree of central bank independence.

The average running cost (“quasi-fiscal costs” represented by the differential between domestic and foreign interest rates) of reserve-holding has been relatively modest over the past decade, and the benefits of substantial foreign reserves were demonstrable during the international financial crisis (especially for Korea, Malaysia and Indonesia). But the interest differential is only one component of the cost of reserve-holding: the central bank also incurs a capital loss when the domestic currency appreciates, which has been the case for almost all these economies. Allowing for this, the cost of reserve-holding is roughly twice as large as the interest differential measure of quasi-fiscal costs. A series of factors seems likely to raise the net cost of reserve-holding in the future, thereby raising questions about how much longer the current trends can be sustained.

Costs of reserve holding

The net cost of foreign exchange reserve-holding is usually measured in terms of the interest differential between the foreign exchange-denominated reserve asset and the domestic funding cost (see Graph 14). There are various ways of calculating this cost: simple interest differential; opportunity cost of funding; opportunity cost in terms of the marginal productivity of capital (Genberg et al (2005)). The cost could be calculated as an average of the various funding sources, or as the cost of the marginal (most expensive) funding source. For our purposes here it will be enough to compare a measure of the income on reserve holdings with the cost of official debt.²² For most countries in this group during the past decade, domestic interest rates have been historically low (reflecting in part the slow recovery from the 1997–98 Asian crisis). With the exceptions of India and Indonesia, the differential to foreign rates has been less than 2%.

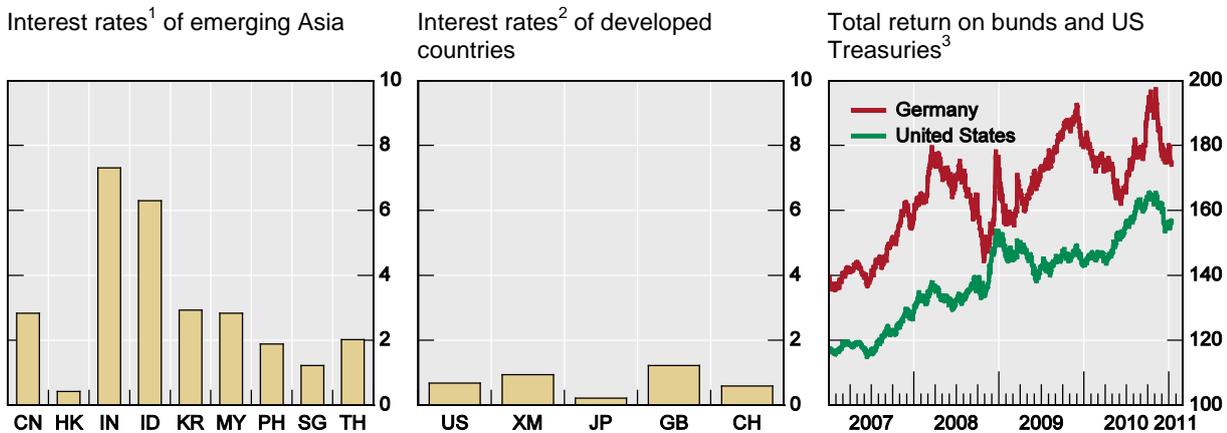
This, however, is an incomplete measure of the costs of holding reserves. If uncovered interest parity (UIP) held, this measure would overstate the cost where domestic interest rates were higher than the foreign interest return: the capital gains on holding the foreign assets would precisely offset the interest differential. While UIP clearly does not hold (see Engel (1996)), the capital gains/losses should be included in the calculation of the cost of reserve holding. In fact, the lesson of the failure of UIP is that the high-interest currencies routinely depreciate by substantially less than the UIP interest differential would imply, and often even appreciate.²³ The capital gains and losses should be taken together with the net interest cost in calculating the costs of maintaining foreign exchange reserves. Graph 14 (right-hand panel) shows that, in recent years, low interest rates in the developed countries have implied considerable capital gains on longer-term bonds; of course, this phenomenon will go into reverse as central banks normalise policy rates.

²² As a rough measure of the financial opportunity cost of holding the foreign exchange assets: if the foreign exchange reserves had not been held, this debt could have been redeemed.

²³ The net of the interest differential and the exchange rate change has tended, for much of the time, to provide a positive return to those who held the high-interest currency. This has led to the popularity (and profitability) of the currency carry trade: borrowing in low-interest currencies and holding high-interest currencies. In effect, building up official foreign exchange reserves puts the authorities in the recipient countries on the other side of the carry trade transactions: the authorities are borrowing in the high-interest rate domestic currency, which is usually appreciating (perversely in terms of the UIP) and holding assets in the low-interest currencies that are losing value.

Graph 14
Interest rates and total bond returns

In per cent / index



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

¹ Latest observed yields of available three-month, six-month, one-year, five-year and 10-year government bills and bonds; weighted average based on amount issued in 2010. ² Simple average of one-year to three-year government bonds. For Switzerland, average of one- and two-year bonds. ³ GBI global traded total return index level, seven-to-10 year, in US dollar terms; 2000–06 = 100.

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

Table 4 shows the change in exchange rates over the past decade. The precise result depends on the period chosen, but the trend and broad message is clear enough: for most of the countries in this group, investing in US dollars results in a loss of around 2% per year, calculated in terms of the domestic currency of these countries.²⁴ For India and Indonesia, the capital appreciation cost has been smaller than the group average but the interest-differential cost has been higher. For the others (except for Hong Kong SAR with its fixed rate), the overall cost of reserve holdings roughly doubles the currency appreciation cost is taken into account.

Capital losses of this nature do not limit the central bank's ability to intervene to restrain an appreciation and to sterilise the effect of that intervention, but they do cause asset valuation losses which weaken their profit-and-loss accounts or their balance sheets. The capital losses on appreciations either diminish profits or are taken into the balance sheet in the form of reductions to reserves.

For most countries, the costs of reserve holding will impinge on the central banks' balance sheets which typically do not have large capital to absorb such losses, especially on an on-going basis. The dominant position of foreign exchange holdings on these balance sheets makes them susceptible to huge losses from currency appreciation: their balance sheets are much more vulnerable and fragile than would be permitted for a commercial bank.²⁵

²⁴ Behind these figures is a more fundamental story of structural change: most of these countries show trend appreciation in their real effective exchange rate (see BIS data), reflecting the Balassa-Samuelson structural effects of higher productivity. For countries that have maintained low inflation, this is reflected in appreciating nominal exchange rates as well. For some countries (eg Indonesia, Hong Kong SAR), the real appreciation took the form of a faster rate of inflation, relative to the US. The outcome, in terms of the cost of holding reserves, is reflected in a different form of cost: higher-inflation countries pay a larger interest differential on their reserve holdings but experience a smaller capital loss.

²⁵ Ho and McCauley (2007) discuss central bank balance sheet losses from appreciation for three countries, including Korea and Thailand.

Table 4
Bilateral exchange rates versus the US dollar

	Percentage changes, end-2001 to latest ¹
CNY	21.53
HKD	0.21
IDR	16.18
INR	2.34
KRW	10.46
MYR	21.12
PHP	13.78
SGD	36.53
THB	41.50

¹ July 2010 for Indonesia; August 2010 for others.

Source: IMF, *International Financial Statistics*.

In all the countries of this group, the foreign exchange reserves are held by the central bank. Accounting conventions differ from institution to institution, but a bank applying IFRS should bring the capital losses associated with appreciation into its profit and loss account (P&L) each year.²⁶ The public reporting of the weakened P&L may diminish the central bank's reputation. Even when these losses are taken into revaluation reserves rather than into the P&L, currency appreciation reduces reserves and net capital.²⁷ If the central bank has to go cap-in-hand to the ministry of finance and parliament to seek their approval for a capital replenishment, the reputational damage may be attended by a weakening of its independence.

The costs of reserve holdings are likely to rise in the future. First, the greater size of the foreign exchange reserves relative to GDP will increase costs. Second, the funding interest differential between domestic and foreign rates seems likely to widen. With interest rates in the reserve currency countries likely to stay low for quite some time and regional domestic rates likely to rise as economic growth resumes, the differential will widen from the abnormally small levels seen over much of the past decade. Larger inflows will be attracted by this wider interest differential, accelerating the accumulation. In addition, credit rating agencies might upgrade the country in question, belatedly adjusting to the region's stronger prospects. Lastly, to the extent that exchange rates will unwind any existing undervaluation, reserve holding will become more costly in terms of capital losses.

²⁶ For discussion of cross-country information on the institutional settings for monetary, exchange rate and intervention policies, see Moser-Boehm (2005).

²⁷ In addition, year-by-year variations in exchange rates can bring about a distribution of capital gains, with depreciations of the domestic currency giving rise to foreign exchange revaluation gains that are recorded as profits and transferred to the budget. Subsequent appreciations impose losses that will diminish capital over time.

Benefits of reserves

Weighed against these net holding costs are the benefits of *precautionary reserves* and the *macro-benefits* from resisting an unwelcome appreciation.

There is a large literature on how much reserve holding is needed for precautionary purposes.²⁸ The usual measures are unsatisfactory.²⁹ A more useful approach would be to see what degree of reserve usage was practised in countries that came under pressure in the international financial crisis, with scenario simulations replacing these arbitrary rules of thumb (Table A1). This sort of country-by-country stress testing might take into account the experience of Korea and Indonesia during the international financial crisis, when the market focused on (and was alarmed by) the *fall* in reserves rather than being reassured by the substantial level of reserves still remaining. This might suggest that large reserve holdings are not a very effective way of providing support to market confidence.³⁰

The macro-motivation for persistent intervention is harder to quantify. There is certainly a perception that a significantly stronger exchange rate would restrain growth in the most dynamic part of the economy – the export sector – and some of the literature suggests that the export-led strategy has been beneficial (Rodrik (2008)). There is also the example of Japan's "lost decade", which many observers see as demonstrating (a least in part) the dangers of rapid exchange rate appreciation when other instruments to offset deflationary pressures are lacking. In an earlier era, Japan's experience during the Bretton-Woods period also supports the idea that an undervalued exchange rate is good for growth.

Against this, there is the near-inevitability of some structural appreciation over time, as encapsulated in the ideas of the Balassa/Samuelson mechanism. When these countries close the technological gap with the advanced economies over time, their equilibrium real exchange rates will appreciate. To resist this rise in the equilibrium rate is expensive in the near term (in terms of valuation losses and other reserve-holding costs) and ultimately futile.

The broad conclusion might be that these countries already have ample reserves and have no prudential reason to accumulate more. Yet the macro-motivation is like a treadmill: just to stay in the same place requires continuous (and probably increasing) accumulation. The additional reserve holdings go beyond a broad notion of the necessary precautionary requirements and, instead, they have to find their justification in terms of investment returns

²⁸ Of course this intervention could be done through official foreign borrowing at the same time as the intervention (running up liabilities rather than running down assets). A number of these countries have, in fact, used the forward markets for intervention rather than draw on reserve holdings (see Graph A1). That said, most countries feel the need to have a substantial level of reserves ("in the shop window") to demonstrate their ability to intervene, and not all countries can be confident of being able to borrow under very adverse circumstances.

²⁹ Early criteria, relating reserves to months of imports, are much less relevant when the capital account provides much of the volatility in the balance of payments. Measures in terms of M2 seem to imply that all those holding domestic currency will seek to convert their currency holdings, whereas the experience is that this does not happen, even in severe crises such as the Asian financial crisis. The Guidotti/Greenspan ratio suggests that countries should hold reserves equal to all the foreign debt falling due over the next year. This might make sense in those countries (eg Latin America) where there are significant longer-term overseas borrowings, where this ratio is designed to enable the country to remain solvent even if borrowers cannot roll over the foreign debt for a year. This metric, however, makes little sense in response to short-term capital inflows: it suggests, in effect, that the short-term inflow should be entirely used to build up foreign reserves, against the possibility that this same inflow proves to be volatile. Rather than the official sector taking on the risks associated with private short-term capital inflows in this way, there is a compelling logic to discourage this sort of inflow.

³⁰ This may suggest that multilateral sources (eg liquidity facilities available through the Chiang Mai Initiative and the International Monetary Fund and central bank swap arrangements) might be more effective, especially when viewed in combination with ample domestic foreign reserve assets.

and national-level portfolio diversification. For many of the region's countries, intrinsic factors seem to make reserve holding a poor investment. A 4% cost (reflecting a 2% interest differential plus a trend appreciation of 2%) combined with reserve holdings equal to half of GDP would result in a cost of roughly 2% of GDP per year. Whether this is calculated as a financial cost (as reflected in the central bank's balance sheet) or in terms of opportunity cost (the benefits that would have accrued had this investment been in a higher-return asset), the message is the same: large reserve holdings have serious macro implications. Whatever rationales there may be for existing levels of reserve holdings, serious questions are raised, for many of the countries in this group, by current policies – which, if continued, will take reserves above levels that can be justified in terms of precautionary benefits.

IV. Towards a sustainable macroeconomic configuration

We noted above that the build-up in foreign exchange reserves has not yet resulted in serious financial pressures. The authorities have seen the growth in credit as benign, a position supported by the strong balance of payments and moderate inflation. But this situation is changing. In 2010–11, inflation pressures have been building significantly, in part because of the advanced stage of the Asian business cycle and in part because of the sharp rise in food and energy prices. And, a soft patch in global economic activity in 2011 has affected both the advanced and emerging market economies.

Looking ahead, a continuation of accommodative monetary policy seems neither desirable nor sustainable. With inflation now showing up more clearly, substantially less monetary policy accommodation is needed in various Asian jurisdictions to ensure price stability (Graph 13). But, these firmer monetary policies are likely to intensify currency appreciation pressures. Unfortunately, the current response – to resist this appreciation by accumulating foreign exchange reserves – will become increasingly costly and could threaten the integrity of central bank balance sheets. More worrisome is the possibility that the substantial volume of “lazy assets” (in the form of low-return sterilisation assets) on the balance sheets of the commercial banks will encourage these banks to lower credit standards and expand credit faster.

To the extent that foreign reserves serve a precautionary purpose, facilitating two-sided intervention that nets out over time, this is sustainable and presents no serious policy conflicts. Intervention in response to an exchange rate that is veering from equilibrium should prove profitable when the exchange rate returns to equilibrium. Variations around the equilibrium give central banks the opportunity to make profits while at the same time stabilising the currency. This profit can offset the costs of reserve-holding. Examples of this sort of exchange rate management can be seen in Korea, Indonesia and Malaysia in 2008.

These examples are, however, the exception in the past decade. Most intervention has been predominantly on one side – to resist appreciation – and hence the trend accretion in foreign reserves.

This does not necessarily imply that the best alternative is a free-floating exchange rate. Rather, it suggests that intervention should be based on an assessment of where the fundamental equilibrium exchange rate (FEER) might lie. This assessment in turn would be based on estimates of the sustainable current account position, and the capital flows that are the counterpart of this position. Of course the precise value of this FEER will be uncertain, so it might best be seen as a band or range, and perhaps quite a wide one if the uncertainties are great.³¹ The band should be wide enough to accommodate the expected changes in the

³¹ See Williamson's BBC proposals (Williamson (2000)).

equilibrium over the course of the business cycle (appreciating in the strong phase of the cycle, weakening in the trough). For countries with terms-of-trade cycles, the band might similarly be wide enough to accommodate the cyclical shift in the equilibrium exchange rate implied by the commodity-price cycle. The band might also appreciate gradually over time, to accommodate the Balassa/Samuelson effect, and could be modified when evidence suggested that the equilibrium was not well centred in the middle of the band.³²

In this framework, the role of foreign reserve accumulation is clear and rule-based. When the exchange rate approaches the edges of the band, the presumption would be that intervention would occur. If the band were centred on the FEER, over time the interventions would be two-way, roughly symmetrical and profitable. This strategy requires that foreign reserves (under the “precautionary” rationale) should be sufficient not only to fund the intervention but also to support the intervention-credibility of the authorities. Of course, the costs of carrying these reserves on the central banks’ balance sheet must be factored into the calculation, over the whole risk cycle.

This approach needs to be embedded in a broader macro-strategy that identifies what a sensible sustainable current account would be for the country. Current account surpluses have been typical in the region over the past decade, perhaps reflecting the disastrous vulnerability that external deficits inflicted in the 1997–98 Asian crisis. But there is a powerful argument that capital should “flow downhill” from the advanced economies towards the emerging countries, with their greater productivity and profitability, as they move towards the technological frontier. This implies a shift in current accounts towards deficit, through an increase in investment (ie the savings/investment balance has to change). In this scenario, the exchange rate would be allowed to appreciate so that it is consistent with this new, more sustainable current account configuration.³³

Foreign capital flows need to match these current accounts if sustainability is to be achieved. While foreign capital shortages are part of the legacy mind-set of many policymakers in the region, inflows are much more likely to be excessive.³⁴ The progressive shift towards the technological frontier holds out the prospect of high productivity and profitability for some decades ahead. With closer global integration, foreign investors are increasingly responding to this underlying profitability differential.

How could these excessive inflows be constrained? This might require a range of capital account management approaches. Controls on capital inflows are now more readily accepted as a legitimate part of the policy toolkit, especially when such controls are market-friendly (eg Chilean-style interest rate taxes) and focused on short-term inflows, which probably provide the least benefit and greatest volatility risk. At the same time countries receiving excessive inflows might have to be prepared to see some of their asset prices rise above equilibrium. Such overpriced assets present the foreign investor with a

³² Detailed specification of this FEER strategy is not explored here. Within this approach, there is room for the edges of the band to be flexible, to be announced or unannounced. The key point here is that successful intervention requires some view on where the equilibrium exchange rate lies, and some ideas about the best tactics for effective intervention around this rate. When floating was seen as the best approach, there was no need to have a notion of what the equilibrium exchange rate might be. But, if a managed float is to make sense, assessments of the equilibrium are needed.

³³ The sterilisation of existing capital inflows is, in effect, a conscious avoidance of the real resource transfer that these financial flows potentially represent. An alternative policy would recognise the benefits of a higher level of investment (with both the funding and real resources coming from overseas). This alternative would also acknowledge that (China and India aside) rates of investment (and GDP growth) have been substantially lower since the Asian crisis of 1997–98. This different macro configuration would result in a greater appreciation of exchange rates, combined with current account deficits, greater investment and faster growth.

³⁴ This conclusion is consistent with the broad historical record for emerging market economies presented by Reinhart and Rogoff (2009).

downside risk of reverting towards their lower equilibrium level, and thus might discourage further inflows. Asset prices in this category would include the exchange rate (thus the authorities might have to accept some degree of persistent overvaluation),³⁵ but would also include equity prices and commercial and residential property, especially the high-end developments favoured by foreign investors.

Conclusion

Our starting point might seem to be similar for most of the region – the fast build-up of foreign exchange reserves as countries intervened to offset foreign capital inflows combined with rapid, perhaps excessive, credit growth. But closer examination suggests differences rather than uniformity. Several countries have had capital outflows rather than inflows (with their foreign exchange accumulation reflecting big current account surpluses rather than capital inflows). While the reserve build-up is large for five of the countries, it is modest for the others. Credit growth is clearly faster than nominal GDP in several of the economies. The policy response also differs: most notably, two countries have monetary approaches which give policy no influence over interest rates, with the only effect on credit growth being via prudential policies and suasion.

Yet a common message does come out of this exploration. All these countries now have foreign exchange reserve levels that are adequate or more than adequate (in some cases, much more). While these countries have, in general, been able to sterilise the impact of foreign exchange reserve build-ups, they do not seem to be able to use the interest rate setting vigorously enough to impinge on the demand for credit when it is growing strongly. They are in transition, not only in their financial sectors, but in their monetary policy. Control over reserve money growth is no longer an effective fulcrum for constraining the growth of bank balance sheets, but they have not yet put in place the full institutional backing (including one that addresses the political economy constraints) for operating monetary policy through interest rates.

Foreign exchange reserves in many emerging Asian economies are now at levels that raise important policy questions about the return on this national investment. With the possible exception of China, all these countries would seem likely to benefit if they allowed the real resource transfer corresponding to capital inflows to occur to a greater extent (ie to move the current accounts in the direction of deficit), using the extra real resources for investment. This investment is likely to be more socially beneficial than the current alternative of holding low-return foreign reserve assets.

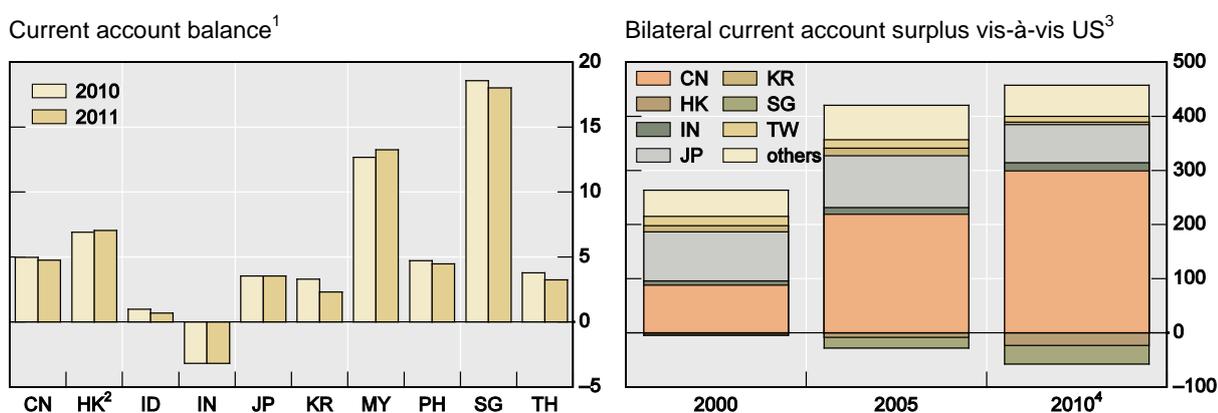
This provides the starting point for an overall macro-response. Current accounts moving towards deficits (with higher investment and faster GDP growth) point to greater appreciation of exchange rates. This does not require the abandonment of the successful policy, over the past decade, of managing the exchange rate to achieve stability and so avoiding a disruptive pace of appreciation. If the authorities are managing the exchange rate so that it is somewhere near the equilibrium consistent with a sustainable current account position, the Impossible Trinity would not be violated. Pressures on this strategy may come from excessive capital inflows, but these can be addressed by accepting some overvaluation of assets, together with active discouragement of short-term capital inflows.

Finally, even though this paper has focused on the issues in emerging Asia, the actions taken by policymakers in the region have significant implications for the global economy.

³⁵ One classical motivation for a transitory exchange rate overshoot of this type is given by Dornbusch (1976). However, the transition may prove to be much longer-lived than in the conventional application of the model.

Graph 15 highlights the fact that current account surpluses in general have been large and in particular substantial and growing with the United States. One issue that we have not addressed in this paper is whether the prolonged and large-scale foreign exchange intervention strategy followed in Asia has effectively worked against the inherent features of the international adjustment mechanism to promote an orderly resolution to global imbalances. To fully understand this important issue, policy spillovers from both sides have to be evaluated. While Asia has certainly pursued exchange rate regimes based on heavy intervention, the West has pursued policies (eg quantitative easing and fiscal deficits) that arguably destabilised the global macroeconomic environment and pushed capital flows into the dynamic emerging market economies. From this perspective, the exchange rate regimes adopted in Asia may be a second-best way of addressing these global frictions.

Graph 15
Current account imbalances in Asia



CN = China; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; TW = Chinese Taipei.

¹ Surplus as a percentage of GDP; Consensus Economics and IMF estimates. ² Goods and services balance. ³ In billions of USD. ⁴ Q4 2010 estimates are average of Q1–Q3 2010.

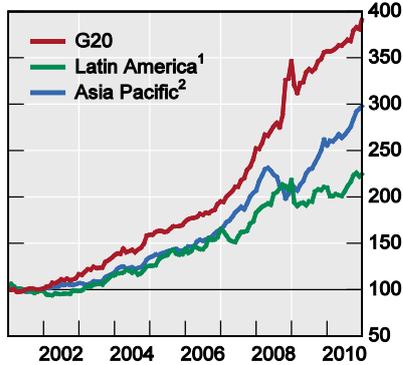
Sources: Consensus Economics®; IMF, *International Financial Statistics*; IMF, *World Economic Outlook*; national data.

In addition, we have not addressed the potentially important implications of a simultaneous surge in central bank balance sheets globally, as was highlighted in Graph 1. While it appears that Asian central banks have been able to sterilise the impact of foreign exchange interventions on domestic inflation, one has to wonder whether the accommodative monetary policy in Asia and that in the advanced economies may be contributing to a surfeit of global liquidity that is finding its way into asset prices and, in 2011, into a surge in commodity prices and into generalised inflation in some economies (Graph 16). The trends in central bank balance sheets also may play a significant role in driving the prices in international financial markets. What might be the implications of a significant shift in the future trend of foreign asset accumulation? Such issues deserve further exploration.

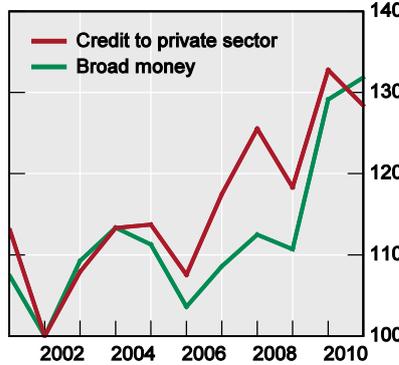
Graph 16
Global dimensions

2001 = 100

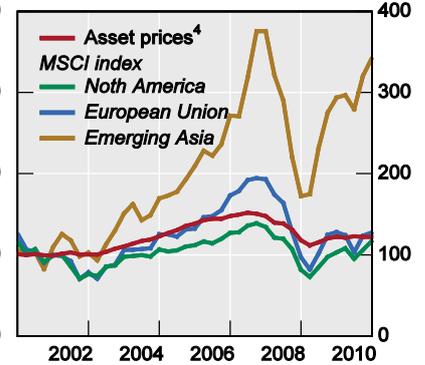
Global central bank balance sheet



Global money and credit³



Global asset prices



¹ Chile, Columbia, Peru and Venezuela. ² Hong Kong SAR, Malaysia, New Zealand, Philippines, Singapore and Thailand. ³ As a percentage of GDP; aggregate of G20 and economies listed at footnotes 1 and 2. ⁴ An index represents equity price, residential property price and commercial property price; weighted average of Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom and United States based on 2005 GDP and PPP exchange rates.

Sources: IMF, World Economic Outlook; IMF, World Economic Outlook; national data.

Annex

Table A1
Foreign reserve adequacy¹
 Outstanding year-end reserves position

	In billions of US dollars			As a percentage of quantity indicated							
				GDP	3-month Imports	Short-term external debt ²			Broad money		
	96	08	10 ³	10 ³	10 ³	96	08	10 ³	96	08	10 ³
Australia	14	29	42	3	89	21	15	15	4	4	3
China	105	1946	2761	49	852	376	1868	1147	11	28	26
Hong Kong SAR	63	178	261	116	283	36	189	226	19	22	28
India	20	247	269	19	351	260	338	235	11	27	20
Indonesia	18	49	86	13	310	51	174	201	15	30	33
Japan	207	1003	1042	19	665	...	264	199	4	12	11
Korea	33	200	287	29	278	45	172	171	6	19	19
Malaysia	26	91	102	47	288	226	402	457	20	35	29
New Zealand	6	11	15	12	222	61	55	93	25	26	31
Pakistan	1	7	13	8	169	19	343	617	2	12	20
Philippines	10	33	53	28	378	121	406	364	26	43	52
Singapore	77	174	218	101	293	44	150	184	73	75	69
Thailand	37	108	162	52	387	80	998	1169	18	38	42
<i>Memo:</i>											
<i>Asia⁴</i>	617	4076	5310	38	351	...	413	391	18	29	30
<i>Latin America⁵</i>	142	440	545	13	345	145	362	270	77	53	...
<i>Central Europe⁶</i>	40	133	180	25	193	383	171	258	39	33	38
<i>Other⁷</i>	29	513	564	17	390	59	272	379	19	42	36

¹ For the outstanding year-end position, regional aggregates are the sum of the economies listed; for percentages, simple averages. For 2009, latest available data. ² Consolidated cross-border claims to all BIS reporting banks on countries outside the reporting area with a maturity up to one year plus international debt securities outstanding with a maturity of up to one year. ³ Latest available data. ⁴ Economies shown above. ⁵ Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela ⁶ The Czech Republic, Hungary and Poland. ⁷ Russia, South Africa and Turkey.

Sources: IMF; Datastream; national data.

Table A2
Central bank total assets

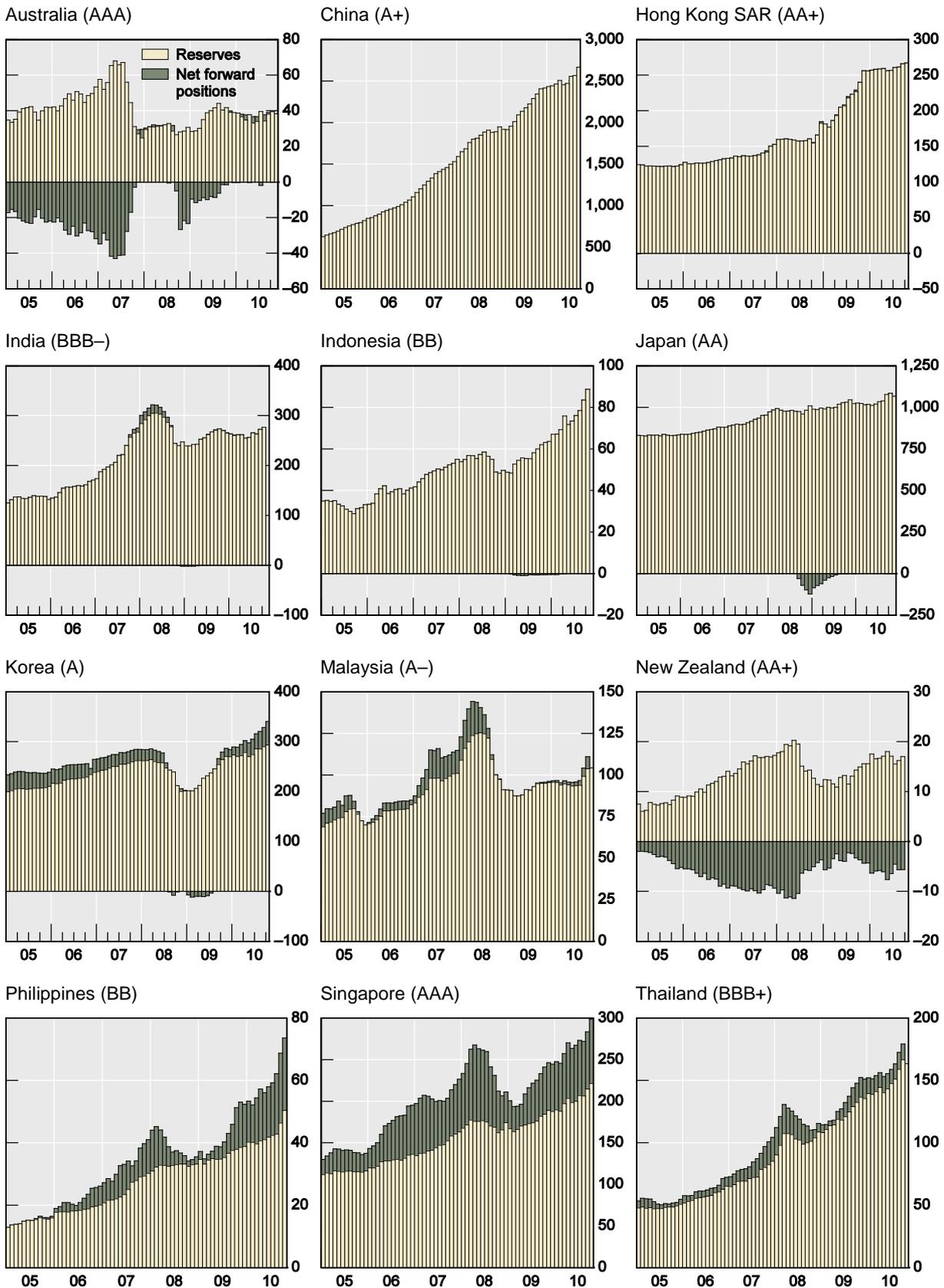
	In billions of USD		As a percentage of quantity indicated							
			GDP		Currency held by the public		M2 ¹		Bank credit ²	
	01	10 ³	01	10 ³	01	10 ³	01	10 ³	01	10 ³
Australia	32	73	8	6	217	165	12	6	10	5
China	516	3680	39	63	272	591	27	35	35	48
Hong Kong SAR	105	259	63	114	811	943	27	35	42	63
Indonesia	60	97	38	15	817	457	74	43	209	66
India	86	340	18	21	180	179	31	27	63	43
Japan	892	1510	24	27	181	174	12	12	21	25
Korea	123	326	25	34	867	1168	35	45	31	33
Malaysia	39	106	42	52	679	949	31	37	33	52
New Zealand	6	23	12	16	675	895	14	18	11	11
Philippines	20	56	28	30	524	718	45	54	79	169
Singapore	79	227	93	98	1232	1343	81	74	79	97
Thailand	46	142	39	48	477	678	34	42	41	51
<i>Memo:</i>										
<i>Euro area</i>	718	2490	12	21	285	230	17	23	11	15
<i>United Kingdom</i>	71	388	5	17	190	562	4	9	4	8
<i>United States</i>	680	2377	7	17	111	263	9	21	13	30

¹ Money plus quasi-money. ² Bank credit to private sector. ³ Latest available data.

Sources: IMF; national data.

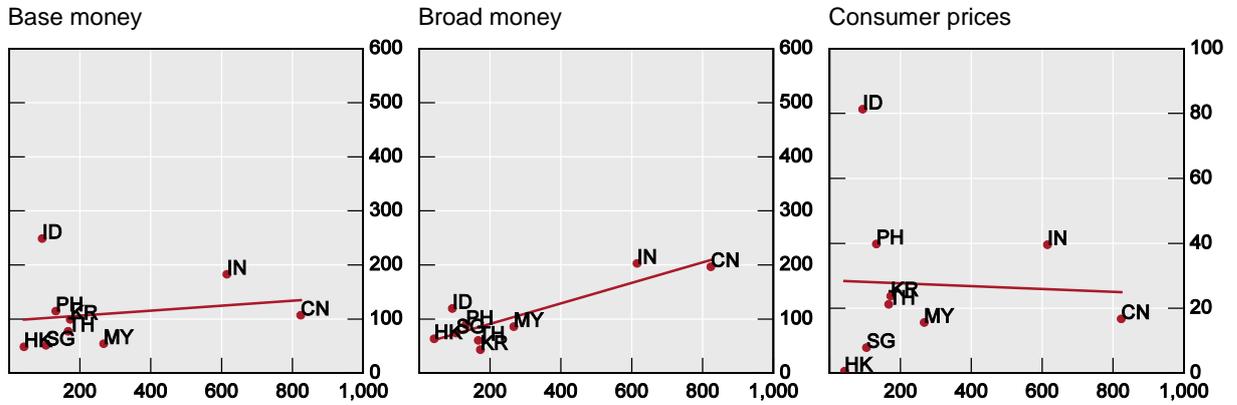
Graph A1
Foreign exchange reserves¹ and net forward positions²

In billions of US dollars



Graph A2
**Growth of foreign exchange reserves relative to the growth of
 money and consumer prices¹**

2001–07; in per cent

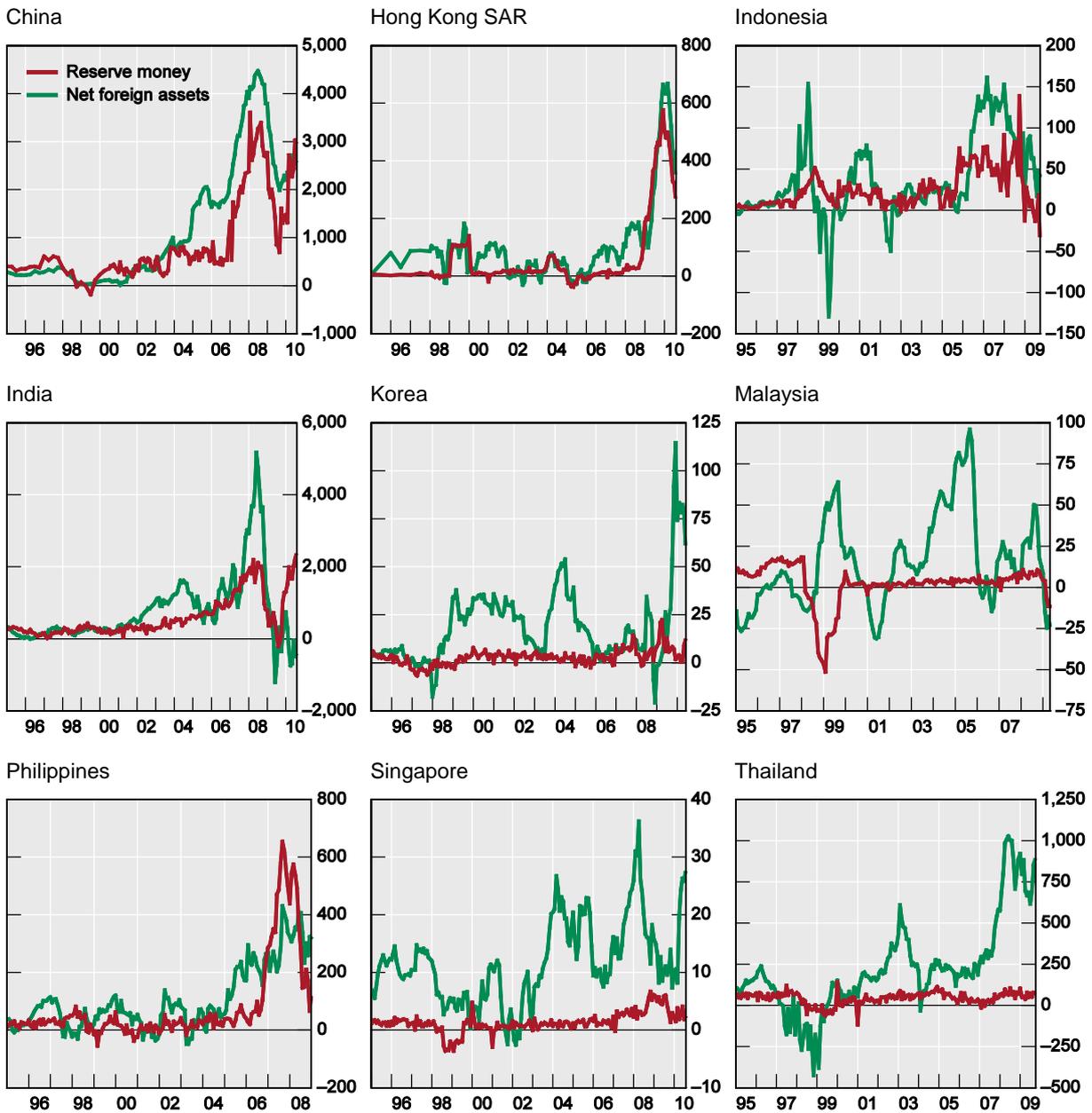


¹ The horizontal axis show change in foreign exchange reserves; the vertical axis represents the change in the variables shown at the panel title.

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

Graph A3
Reserve money and net foreign assets, by economy

Annual changes, in billions of local currency¹



¹ For Indonesia and Korea, trillions of local currency.

Sources: IMF, International Financial Statistics.

References

- Adrian, T, and H Shin (2009): “Financial intermediaries and monetary economics”, *Federal Reserve Bank of New York Staff Report*, no 398.
- Aizenman, J (2010): “The impossible trinity (aka the policy trilemma)”, *Encyclopedia of Financial Globalization*.
- Aizenman, J, and R Glick (2008): “Sterilization, monetary policy, and global financial integration”, *mimeo*.
- Aizenman, J, M Chinn and H Ito (2008): “Assessing the emerging global financial architecture: measuring the trilemma’s configurations over time”, *NBER Working Paper*, no 14533, December.
- Amato, J, A Filardo, G Galati, G von Peter and F Zhu (2005): “Research on exchange rates and monetary policy: an overview”, *BIS Working Papers*, no 178, June.
- BIS (2009): “Capital flows and emerging market economies, Report submitted by a Working Group established by the Committee on the Global Financial System”, *CGFS Papers*, no 33.
- BIS (2010): *80th Annual Report*, Basel, June.
- Borio, C, and P Disyatat (2009): “Unconventional monetary policies: an appraisal”, *BIS Working Papers*, no 292.
- Borio, C, J Ebbesen, G Galati and A Heath (2008a): “Foreign exchange reserve management: elements of a framework”, *BIS Papers*, no 38.
- Borio, C, G Galati and A Heath (2008b): “Foreign exchange reserve management: trends and challenges”, *BIS Papers*, no 40.
- Borio, C, and H Zhu (2008): “Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?”, *BIS Working Papers*, no 268.
- Calvo, G (1991): “The perils of sterilization”, *IMF Staff Papers*, vol 38, no 4, pp 921–6.
- Chai-Anant, C, and C Ho (2008): “Understanding Asian equity flows, market returns and exchange rates”, *BIS Working Papers*, no 245.
- Chung, K (2009): “Household debt, the savings rate and monetary policy: the Korean experience”, *BIS Papers*, no 46.
- Cline, W R, and J Williamson (2010): “Estimates of fundamental equilibrium exchange rates”, *Peterson Institute of International Economics Policy Brief*, no 10-15.
- Danthine, J-P (2011): “Market developments, Swiss monetary policy and foreign exchange reserve management”, introductory remarks at the half-yearly media news conference, <http://www.bis.org/review/r110628c.pdf?frames=0>, June.
- Disyatat, P (2010): “The bank lending channel revisited”, *BIS Working Papers*, no 297.
- Dornbusch, R (1976): “Expectations and exchange rate dynamics”, *Journal of Political Economy*, December.
- Endut, N, and T G Hu (2009): “Household debt in Malaysia”, *BIS Papers*, no 46.
- Engel, C (1996): “The forward discount anomaly and the risk premium: a survey of recent evidence”, *Journal of Empirical Finance*, vol 32, pp 305–19.
- Fischer, S (2001): “Exchange rate regimes: is the bipolar view correct?”, *Journal of Economic Perspectives*, Spring.
- Genberg, H, R McCauley, Y C Park and A Persaud (2005): “Official reserves and currency management in Asia: myth, reality and the future”, *Geneva Reports on the World Economy* 7.

- Glick, R, and M Hutchison (2008): “Navigating the trilemma: capital flows and monetary policy in China”, *Federal Reserve Bank of San Francisco Working Papers*.
- Hauner, D (2005): “A fiscal price tag for international reserves”, *IMF Working Papers* 05/81.
- Hauner, D (2006): “A fiscal price tag for international reserves”, *International Finance* 9:2, pp 169–95.
- He, D, F Leung and P Ng (2009): “A framework for monitoring capital flow in Hong Kong”, *HKIMR Working Paper* 16/2009.
- Ho, C, and R McCauley (2007): “Resisting appreciation and accumulating reserves in Asia: examining the domestic financial consequences”, *BIS papers*.
- Hutchinson, M, R Sengupta and N Singh (2010): “India’s trilemma: financial liberalisation, exchange rates and monetary policy”, unpublished manuscript, August.
- Ma, G, X Yan and X Liu (2011): “China’s reserve requirements: practices, effects and implications”, *BIS Working Paper*, unpublished, August.
- McCauley, R (2007): “Assessing the benefits and costs of official international reserves”, in Bakker, A (ed), *Central bank reserve management*.
- McCauley, R, and G Ma (2008): “Resisting financial globalisation in Asia”, *Bank of Thailand International Symposium 2008*.
- 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.
- Moser-Boehm, P (2005): “Governance aspects of foreign exchange interventions, foreign exchange market intervention in emerging markets: motives, techniques and implications”, *BIS Papers*, no 24.
- Ouyang, A, R Rajan and T Willett (2007): “Managing the monetary consequences of reserve accumulation in emerging Asia”, *HKIMR Working Paper*, no 20/2007.
- Reinhart, C, and K Rogoff (2009): *This time is different: eight centuries of financial folly*, Princeton University Press.
- Rodrik, D (2008): “The real exchange rate and economic growth”.
- Stella, P (1997): “Do central banks need capital?”, *IMF Working Papers*, no 97/83.
- Subhanij, T (2009): “Household sector and monetary policy implications: Thailand's recent experience”, *BIS Papers*, no 46.
- Turner, P (2011): “Fiscal dominance and the long-term interest rate”, *LSE Financial Markets Group Special Paper Series*, no 199, May.
- Williamson, J (2000): *Exchange rate regimes for emerging markets: reviving the intermediate option*, Institute for International Economics (Washington).