



BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers

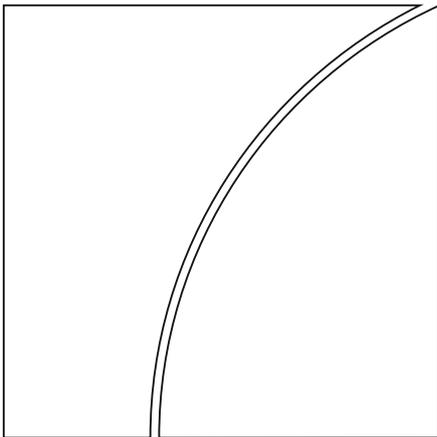
No 463

Monetary analysis and the global financial cycle: an Asian central bank perspective

by Andrew Filardo, Hans Genberg and Boris Hofmann

Monetary and Economic Department

September 2014



JEL classification: E42, E58, F42

Keywords: central bank mandates, financial cycle, financial inclusion, globalisation, managed exchange rates, monetary analysis, monetary policy frameworks, emerging Asia

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

© *Bank for International Settlements 2014. All rights reserved. Brief excerpts may be reproduced or translated provided the source is stated.*

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Monetary analysis and the global financial cycle: an Asian central bank perspective

Andrew Filardo (BIS), Hans Genberg (SEACEN) and Boris Hofmann (BIS)¹

Abstract

EM Asia has seen a transformation of its monetary policy environment over the past 2 decades. By far, the most relevant change has been the maturing of its financial systems and the growing relevance of the global financial cycle: financial inclusion has spread, financial markets have deepened and financial globalisation has linked domestic markets closer to international markets. One consequence of the maturing of the financial systems has been the weakening of the traditional case for the monetarist view of the roles of monetary and credit aggregates in the conduct of monetary policy: velocity has been unstable in ways similar to that in the advanced economies decades earlier; yet, longer-term monetary growth correlations with inflation are evident.

In addition, the maturing of the financial systems has elevated concerns of financial stability, as both a source of shocks and as something central banks have a responsibility for. These developments have been further complicated by monetary policy spillovers from the advanced economies. The challenge now is how best to integrate mandates for financial stability into monetary policy frameworks, both conceptually and practically. Moreover, the exchange rate choice is particularly relevant in EM Asia. While managed exchange rate regimes in EM Asia have been implemented with mixed success, the risks associated with the choice can be seen through the lens of aggregates based on central bank balance sheets. The size and growth of central bank balance sheets suggest an ongoing build-up in risks.

All this points to the need to consider alternatives to conventional inflation targeting frameworks. This paper lays out a policy framework based on a multi-pillar monetary policy approach as a potentially attractive alternative for EM Asia. The three pillars are based on economic, financial and exchange rate stability, respectively. This framework not only offers an alternative conceptual framework but also implies institutional reforms to ensure central banks take a longer term perspective when setting policy.

Keywords: central bank mandates, financial cycle, financial inclusion, globalisation, managed exchange rates, monetary analysis, monetary policy frameworks, emerging Asia

JEL codes: E42, E58, F42

¹ This paper was prepared for the SIRE-MMF-RES-HWU Conference on "Monetary analysis and monetary policy frameworks" on 9-10 April 2014 in Edinburgh, Scotland. The views expressed in this article are those of the authors alone and do not necessarily reflect those of the BIS or the SEACEN Centre. We are grateful to David Archer, Claudio Borio, Joe Byrnes, Paul Mizen, Philip Turner and participants at the SIRE-MMF-RES-HWU Conference for comments on the paper, to Mathias Drehmann for making available the results on the performance of the credit-to-GDP gap as an early warning indicator for financial crises, and to Lillie Lam for excellent research assistance.

Contents

Abstract	i
Introduction	1
I. Central banking in a changing global macro-financial environment	2
Macro-financial trends in EM Asia.....	2
Price stability	2
Financial deepening and inclusion.....	3
Financial globalisation.....	6
Some implications for monetary transmission in EM Asia	9
II. An enduring role for monetary analysis in EM Asia.....	9
The decline of the traditional monetarist perspective	11
The rise of the financial cycle perspective.....	14
Factoring in the global financial cycle perspective.....	16
Foreign exchange rate management and quantitative aggregates in EM Asia.....	19
III. Implications for monetary policy frameworks.....	23
Pillar 1: a traditional macroeconomic stability pillar	23
Pillar 2: a financial stability-oriented monetary policy pillar	24
Pillar 3: an exchange-rate-management-oriented pillar	27
IV. Conclusions.....	29
References	30
Previous volumes in this series	36

Introduction

Emerging market economies in Asia have been successful in achieving price stability and robust economic growth. They have done so using a variety of monetary policy strategies (Filardo and Genberg (2010)), some declaring themselves adherents to conventional inflation targeting approaches based on inflation forecasts and using an interest rate as the policy instrument, others adopting exchange rate-based strategies, while still others have been following eclectic approaches with respect to multiple goals, indicators and instruments.

Since the Asian Financial Crisis the region has also achieved a good record in terms of financial stability notwithstanding the financial turmoil in many other parts of the world, most notably in the United States and Europe during 2008-2009 and thereafter. Indeed some observers in the region object to the term Global Financial Crisis associated with that period, on the grounds that there was not a financial crisis in Asia. The recession in the region was largely due to the slowdown in the global economy during this period and its consequence for export-dependent economies in the region.

This paper argues that, despite these favourable performances, greater financial inclusion and deepening as well as globalisation of their economies suggest scope for a reconsideration of EM Asian monetary policy frameworks in particular with respect to the role of quantitative aggregates. Increased financial market inclusion and deepening and greater financial globalisation have brought important benefits to EM Asia in terms of economic development and welfare. However, there are indications that they have also fostered the build-up of financial and economic vulnerabilities similar to those that preceded the 2008-09 crisis in some advanced economies. This points to the need to be vigilant with respect to monetary and financial developments that may signal the build-up of such vulnerabilities and to analyse the implications of financial deepening and globalisation trends for monetary relationships that inform monetary policy.

Another key development in EM Asia has been the large-scale interventions by monetary authorities in foreign exchange markets. They have contributed to a massive expansion of central bank balance sheets in several jurisdictions as monetary authorities conducted large-scale interventions in FX markets out of concerns about the consequences of exchange rate volatility for competitiveness and employment. This paper suggests that the expansion is creating a number of significant risks for the central banks themselves and for the economy as a whole. This approach to exchange rate management highlights the growing importance of monitoring trends in foreign exchange reserves (ie trends in EM central bank assets) and their implications both for domestic financial and monetary conditions and for price and financial stability oriented monetary policy frameworks.

Asian central banks can thus be characterised as being concerned with three important policy objectives (ie price stability, financial stability, and avoiding excessive exchange rate volatility) and employing various instruments such as policy interest rate, macroprudential tools, and interventions in the foreign exchange market to achieve them. The multiplicity of objectives and instruments raises considerable challenges with respect to how these instruments should be managed when each has an influence on all three objectives, albeit with different intensity, and when attempting to reach one objective may intensify problems associated with

the others. These challenges are compounded by developments in financial markets that alter policy transmission mechanisms and magnify shocks to the economy.

This paper is an attempt to outline a monetary policy framework that incorporates the three revealed preference concerns of Asian central banks and the three types of policy instrument used to deal with them. It does so by first documenting the successful record with respect to inflation and growth in emerging Asian economies. We then focus on the increasing sophistication, financial inclusion and depth of financial markets in the region and the greater integration in the global financial system, which have affected monetary conditions in Asia in fundamental ways. We present evidence that the role of the narrow monetary aggregates as indicators of traditional central bank objectives for inflation and growth has declined, albeit not completely. We then argue that monitoring the broad monetary and credit aggregates, and understanding the underlying drivers, has become increasingly important for central banks' medium-term financial stability objectives as well as for the special role played by quantitative measures of monetary policy in current exchange rate regimes; we also draw attention to potential risks associated with the build-up of international reserves resulting from interventions in the foreign exchange markets.

The paper suggests that monetary policy frameworks based on a multi-pillar approach may offer many advantages worthy of consideration, and that this approach places considerable emphasis on the monitoring and analysis of quantitative aggregates.

I. Central banking in a changing global macro-financial environment

This section reviews the macro-financial trends in EM Asia and the shifting relevance of monetary analysis.

Macro-financial trends in EM Asia

The macro-financial environment has been shifting significantly over the past two decades. While the central bank focus on price stability has firmly taken root in EM Asia, financial inclusion, domestic financial market deepening and increased financial globalisation have progressed.

Price stability

In the aftermath of the Asian crisis, monetary policy has increasingly emphasised price stability as a primary objective of monetary policy. Although methods of pursuing this objective vary across jurisdictions, the outcomes have been similar; inflation has been maintained in a range roughly consistent with 'price stability' during much of the recent two decades. (Graph 1, left-hand panel) The exceptions are the years 2008 and 2009 where swings in commodity prices and sharp exchange rate movements, and the associated pass-through of import prices, led to gyrations in inflation rates. This serves as a reminder that the region remains highly dependent on global economic developments, even if intra-regional trade has expanded substantially. Dependence on global factors is also clearly visible in the

region's growth performance (Graph 1, right-hand panel) which has been relatively stable in the 5-10% range, except during the Asian Financial Crisis and in 2009.

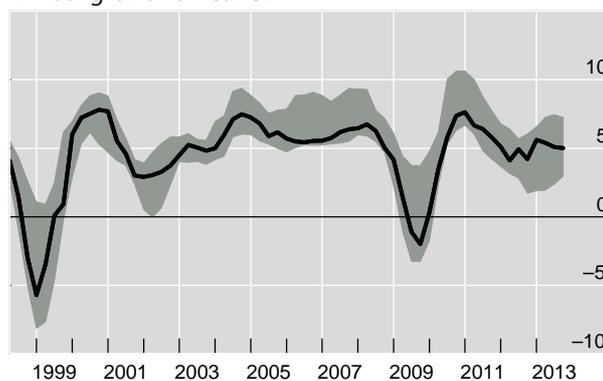
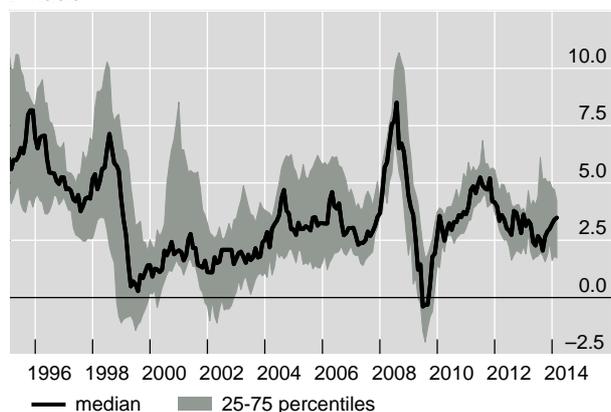
Inflation and economic growth¹

Per cent

Graph 1

Inflation²

Annual growth of real GDP



¹ China, Hong Kong SAR, Indonesia, India, Korea, Malaysia, Philippines, Singapore and Thailand. ² Based on wholesale price index for India; consumer price index otherwise.

Source: national data; BIS calculations.

Financial deepening and inclusion

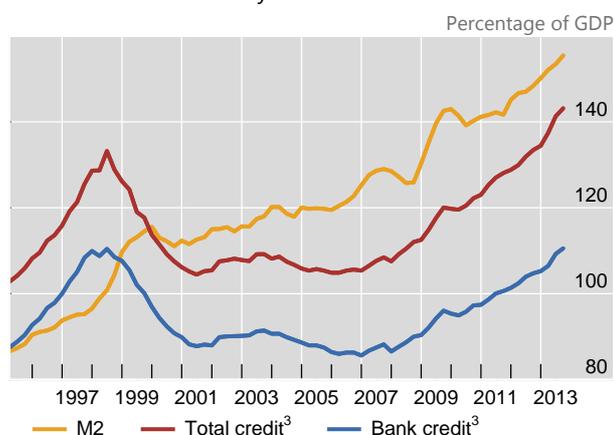
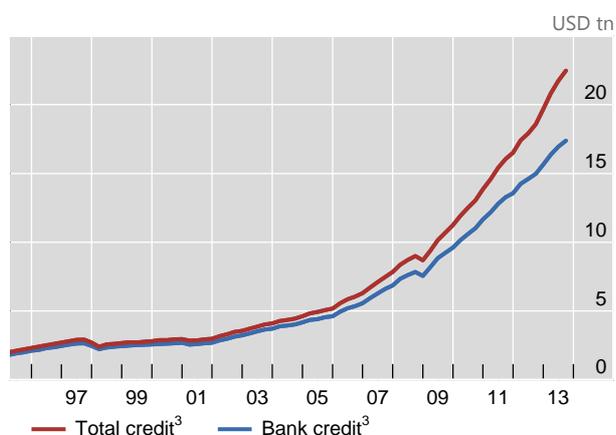
Domestic financial markets in EM Asia have gone through a significant deepening, reflected in the rapid expansion of credit to the private sector. Since 1998, bank credit to the private sector has increased by a factor of six and that of total credit by a factor of seven (Graph 2, left-hand panel). Credit-to-GDP ratios, widely used

Financial deepening

Graph 2

Domestic credit^{1,2}

Credit and broad money^{1,4}



¹ China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. ² Aggregate of the list economies except the Philippines. ³ Domestic credit to non-financial private sector; total credit is not available for the Philippines. ⁴ Simple average of the list economies.

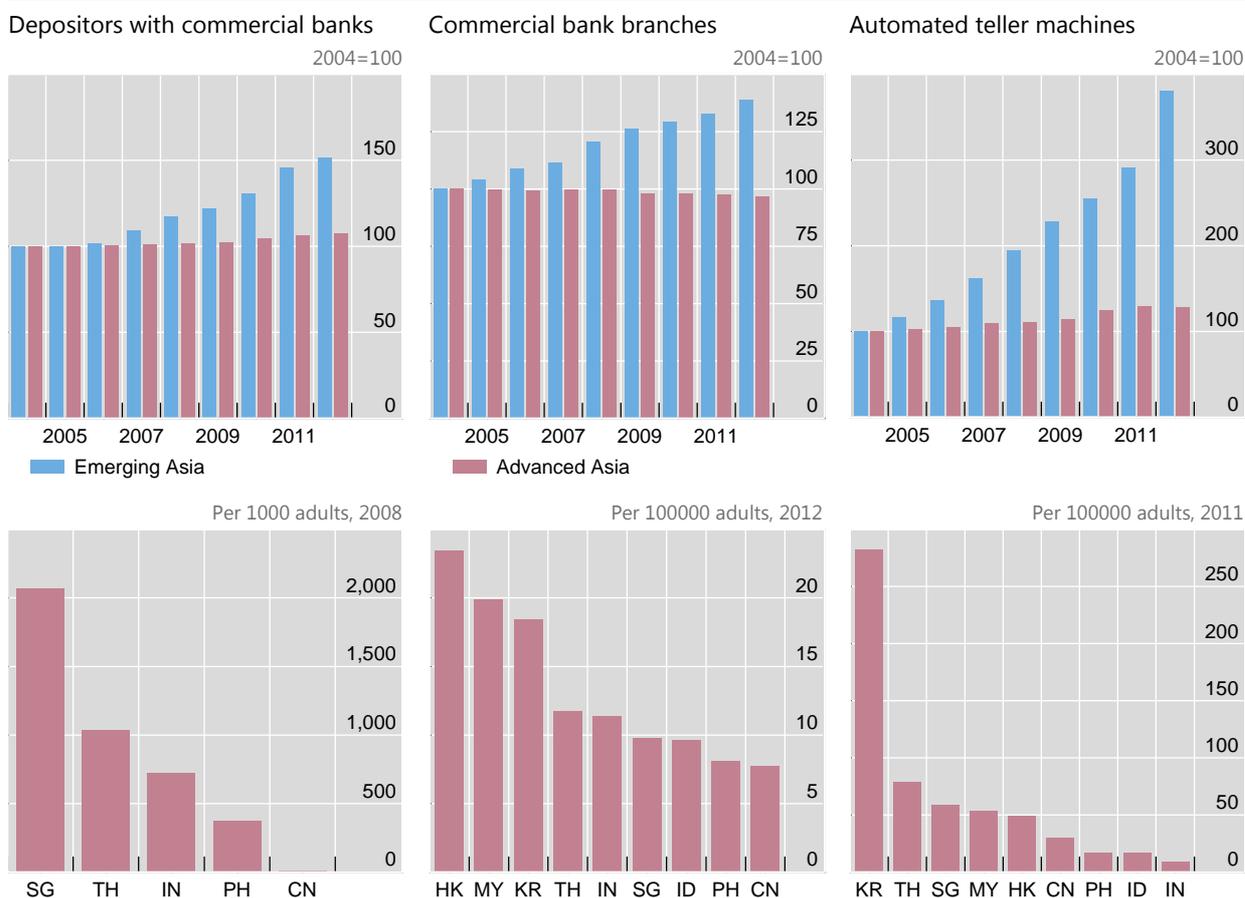
Sources: IMF, *International Financial Statistics*; Datastream; national data.

indicators of financial deepening, suggest that financial deepening has picked up momentum since 2008 (Graph 2, right-hand panel), recently surpassing levels last achieved in the period just before the Asian Financial Crisis. The ratio of broad money-to-GDP has also surged. Unlike the experience in the advanced economies, money-to-GDP ratios in EM Asia exceed credit-to-GDP ratios, a development reflecting the large stock of public securities held by the domestic banking sector.

This maturing of EM Asian financial systems has been reflected concretely in the enhanced provision of banking services at the grassroots level. This has translated into a rise in competition for banking services and greater financial inclusion. In terms of bank accounts, bank branches and ATMs, the trends are unmistakable even if the levels of the penetration vary widely across economies (Graph 3).

Banking services in Asia¹

Graph 3



¹ Index based on a simple average of annual growth rates for which data are available. Levels are shown for the year containing the largest number of observations. EM Asia is represented by CN, IN, ID, ML, PH and TH; Advanced Asia by HK SAR, KR and SG.

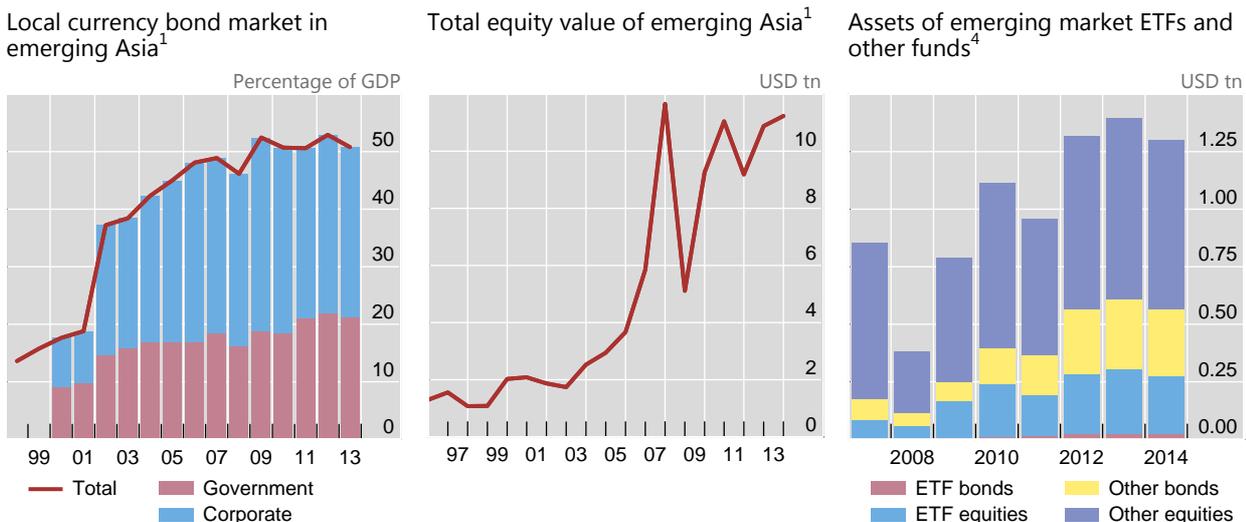
Source: Worldbank.

The development of domestic capital markets is also playing an important role in financial deepening and greater financial inclusion in EM Asia. The widening of the gap between total and bank credit reflects in part greater reliance of EM Asian corporates on capital markets. The capitalisation of bond markets has risen considerably in the 2000s (Graph 4, left-hand panel), driven in particular by

corporate bond issuance. Equity markets have also played an important role in the financial maturing of EM Asia economies. Total equity valuations have been quite volatile but have returned to pre-crisis peaks (both the Asian Financial Crisis peaks and the International Financial Crisis peaks). This has allowed firms in Asia to raise funds at more favourable prices (Graph 4, middle panel) and has offered an alternative vehicle for raising funds outside the banking and bond markets. The right-hand panel of Graph 4 illustrates the attractiveness of EM equity ETFs in recent years. These trends reflect greater foreign investment penetration and global financial integration.

Market capitalisation

Graph 4



¹ Aggregate of China, Hong Kong SAR, India, Indonesia, Korea, the Philippines, Singapore and Thailand. ² Net asset value.; as of 31 January 2014.

Sources: WorldBank; AsianBondsOnline; Bloomberg; EPFR; national data.

The growing gap between total and bank credit in EM Asia was also driven partially by a rapid expansion of the shadow banking sector. Estimates from Ghosh et al (2012) indicate that for Thailand and the Philippines the share of the shadow banking sector in total financial assets may be as high as 35-40%. For Indonesia, the estimates are about 20% and for China 10-15%. Moreover, the shares have been rising over the past decade. On the one hand, this more informal form of financial intermediation allows those who are unable or unwilling to access the traditional banking sector to obtain lending. On the other hand, the shadow banking sector is unregulated and may contribute to financial stability concerns both directly and indirectly via its interconnectedness with the rest of the financial system. This is especially the case when the activity is driven primarily by the desire to circumvent banking regulations.

In terms of monetary analysis, the existence of a significant and growing shadow banking system creates challenges because of the difficulty in accurately measuring the full range of shadow banking activities. The main challenge is that reported broad monetary and credit data will be incomplete measures of total credit activities. In China, for example, this gap between bank credit and total credit has led to the adoption of a broader credit measure, namely the total social credit aggregate. This aggregate includes bank credit as well as official credit, off-balance-

sheet financing and direct financing through equity and bond issues. Since its introduction a few years ago, the total social credit aggregate has been more highly correlated with real economic activity than bank credit alone. The People’s Bank of China uses this aggregate “as a reference for the adjustment of monetary policy.”

Financial globalisation

The nature of the global financial flows to EM Asia is evolving in ways that raise concerns about financial fragility and the information content of the monetary and credit aggregates. Increasingly, the aggregates are providing information about the cross-border vulnerabilities faced in the region.

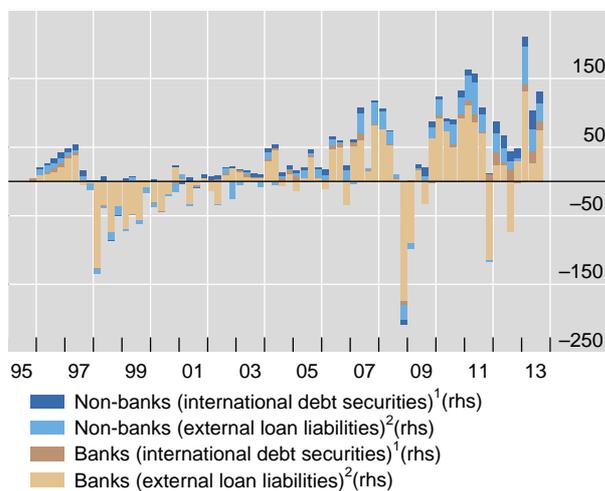
During the pre- and immediate post-Bretton Woods period, official financial flows were dominant. As such, balance of payment dynamics and the response of governments to the need for equilibrating flows were critical elements of the financial cycle; in part, the financial cycle was tamed via financial repression (Reinhart and Sbrancia (2011)). During the early part of the floating exchange rate period, banking flows along with some equity and bond flows became much more important. In this sense, internationally active banks played an increasingly important role in determining the nature of the cross-border financial flows. The Asian Financial Crisis in the late 1990s, which has been associated with strong outflows of bank credit from EM Asia, underscored the risks that accompanied this development (Graph 5, left-hand panel).

Credit flow and international debt securities issuance

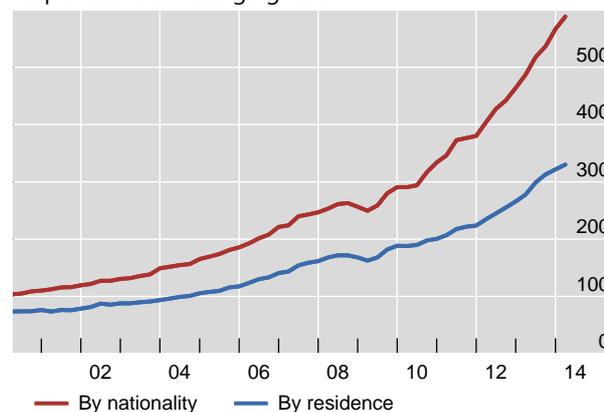
In billions of US dollar

Graph 5

Credit flows to emerging Asia and the pacific



International debt securities issued by non-bank corporations in emerging Asia³



¹ Net issues of international debt securities, all issuers, in all maturities, by residence of issuer. ² External loans of BIS reporting banks vis-à-vis individual economies; estimated exchange rate-adjusted changes. ³ Amount outstanding of international debt securities issued by non-bank financial corporations and non-financial corporations; aggregate of China, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand.

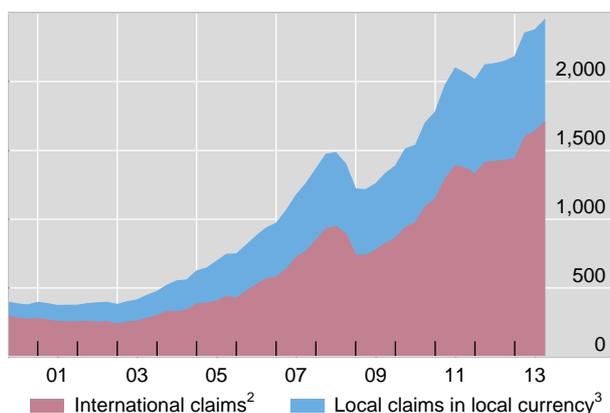
Sources: BIS locational banking statistics by residence; BIS debt securities statistics.

Foreign claims on EM Asia and international debt securities denominated in EM Asian currencies

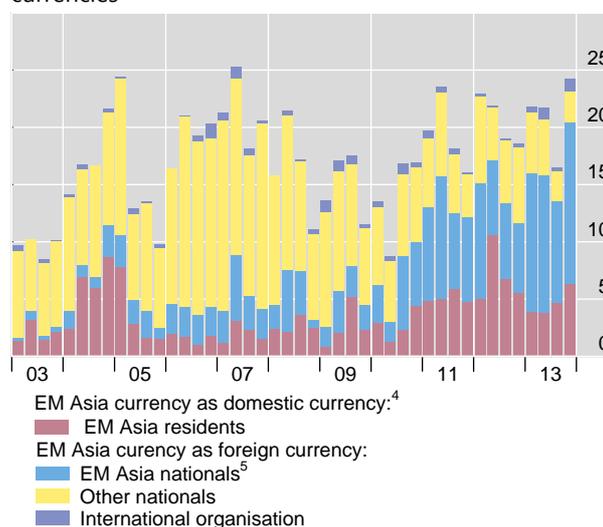
In billions of US dollar

Graph 6

Foreign claims on developing Asia and Pacific¹



International debt securities denominated in EM Asian currencies



¹ Positions of BIS reporting banks. Data are not adjusted for exchange rate movements. ² International claims comprise cross-border claims in all currencies and local claims in foreign currencies. ³ Local claims in local currency comprise local currency claims of reporting banks' foreign offices with local residents. ⁴ "Domestic currency" refers to international issues denominated in the currency of the country where the borrower resides. ⁵ "EM Asia nationals" refers to foreign affiliates of borrowers headquartered in an emerging market economy.

Sources: BIS consolidated banking statistics; BIS debt securities statistics.

Over the past decade, EM Asia has been increasingly integrated into the global financial system.² Credit flows to EM Asia have been on a strong upward trend (Graph 5, left-hand panel). The flows gathered momentum between 2003 and 2007, but retrenched following the collapse of Lehman Brothers in late 2008 and again during the European sovereign bond crisis. Since then, credit flows have picked up as global risk appetite has risen. The greater integration of EM Asian corporates into global financial markets is also reflected in increased debt issuance offshore. The difference between corporate international debt issuance by borrower nationality and by residence – reflecting offshore issuance in particular – has widened considerably since the crisis in Asian EMEs (Graph 6, right-hand panel).³ At the same time, as a consequence of the increased foreign investor participation in EM financial markets that was mentioned before, foreign investors have become important players in key financial market segments. For instance, non-residents

² See CGFS (2014) for a particular focus on trends in the post-crisis period based on international bank claims, international bond issuance data, portfolio flows, syndicated loan underwriting and changes in foreign ownership shares in banks. The report also discusses the key drivers of cross-border banking activity.

³ See Caruana (2013), McCauley et al (2013) and Mizen et al (2012).

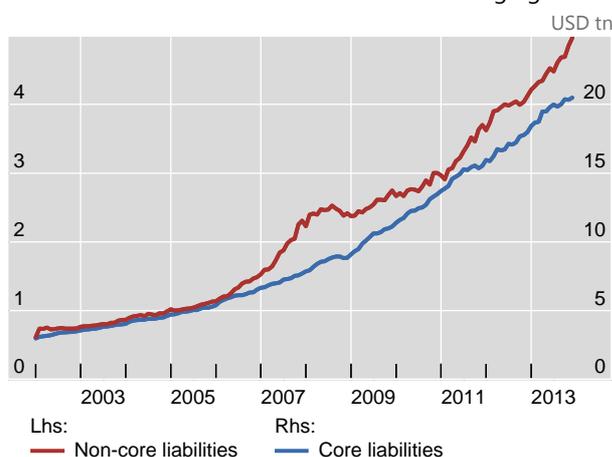
held, on average, an estimated 26.6% of EME local currency debt in 2013, up from 12.7% in 2008.⁴

Over time, the accumulation of persistent flows has driven foreign claims on EM Asia from around \$300 billion in 2003 to almost \$2.5 trillion in 2013 (Graph 6, left-hand panel). While the bulk of these claims are international claims, local claims in local currency have been increasing strongly over this period, reflecting in large part the rapid development of local currency bond markets and the growing foreign investor participation in these markets. EM Asian nationals have also been increasingly able to issue international debt securities in EM Asian currencies (Graph 5, right-hand panel). That said, the US dollar continues to account for the bulk of EM borrowers' international issuance by a large margin, with a share of new placements by EM nationals averaging more than 70% since 2010.⁵

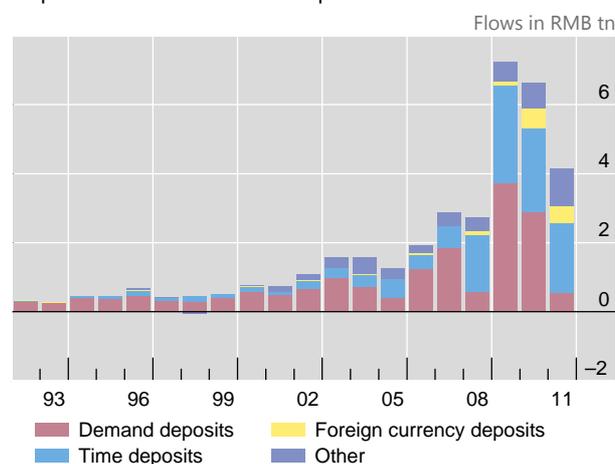
Non-core liabilities of banks and deposits of non-financial corporates

Graph 7

Non-core and core liabilities of banks in emerging Asia¹



Deposits of non-financial corporates in China



¹ Aggregate of China, Hong Kong SAR, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand.

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

These financial globalisation trends suggest the main drivers of macro-financial vulnerabilities are changing and have also had important effects on domestic monetary trends. In particular, non-core liabilities have been growing robustly in EM Asia over the past decade (Graph 7, left-hand panel), reflecting a potential build-up of vulnerabilities in the banking sector.⁶ As suggested by Borio and Lowe (2004) and Hahm et al (2012), for example, when credit growth outpaces the growth in retail deposits, banks will turn to less stable sources of funding such as non-core liabilities. Kim et al (2013) show that these non-core liabilities have been driven to a large extent by private sector banks' FX borrowing. Non-core liabilities are therefore

⁴ See World Bank (2013).

⁵ See BIS (2013) for a more detailed analysis of the issuance of international bonds denominated in EM currencies.

⁶ Hahm et al (2012) and Kim et al (2013) present evidence supporting the notion that non-core liabilities are useful indicators of financial vulnerabilities.

important indicators of cross-border borrowing trends which increase the potential impact of capital flow sudden stops.

More recently, the sharp increase in offshore corporate bond issuance has been associated with a strong expansion in deposits of non-financial corporates. Graph 7 (right-hand panel) documents the sharp increase in the nonfinancial corporate (NFC) deposits in the case of China. Similar trends are also visible in other Asian countries where data on NFC deposits are readily available, such as Korea and the Philippines. When large NFCs raise funds through bond issuance in international bond markets, this has implications for domestic financial conditions if the NFCs deposit the funds in their domestic banking system and the deposits are used to support more lending to other borrowers (Shin and Zhao (2013) and Chung et al (2014)). Financial conditions in the economy may further ease if banks look for additional, less credit-worthy, borrowers as large firms turn to capital market financing. All this suggests that NFC deposits may have become an important indicator of financial vulnerabilities in EMEs.

Some implications for monetary transmission in EM Asia

Greater domestic financial deepening and inclusion as well as greater integration of the domestic financial system with global financial markets have important implications for the transmission of monetary policy. Financial deepening and inclusion has boosted the interest-sensitivity of aggregate demand in the economy, giving the central bank more leverage to influence economic activity. The expanded role of capital markets in EM Asia, in particular of local currency bond markets, should also render the transmission of short-term policy rate impulses more indirect as longer-term interest rates become more important (Turner 2014). For central banks, this suggests that greater attention now needs to be given on communicating longer-term strategies for monetary policy, as the entire yield curve becomes more relevant for aggregate demand.

The implications of financial globalisation on the monetary transmission mechanism in EM Asia, and on monetary policy effectiveness more generally, raise challenges for central banks. On the one hand, greater integration of financial markets is making exchange rates, and hence the terms of trade (in the short run), more sensitive to monetary policy decisions. On the other hand, this integration has made it difficult for central banks to influence domestic long-term real interest rates as real rates become more closely linked to foreign real rates. Some have recently emphasised that domestic interest rate policy loses its potency in such an environment (Rey (2013)).

II. An enduring role for monetary analysis in EM Asia

What are the implications of the macro-financial developments for central banks' monetary analysis? A number of issues stand out. First, financial inclusion and deepening complicates the information value of the growth in monetary and credit aggregates. Moreover, the development and use of more complex domestic financial instruments has rendered the demand for money less stable and hence less useful as an indicator of risks to price stability.

Second, financial inclusion and deepening in EM Asia has increased the relevance of the financial cycle for macroeconomic and financial stability. One way to look at these developments is through the lens of modern macroeconomics, accounting for the role of credit developments and their cyclical propagation. Most theoretical models, however, still assume relatively simplistic roles for financial factors. Another way to look at financial factors is to appeal to a much older understanding of the financial cycle (eg Eckstein and Sinai (1986)). This approach emphasised the recurrent nature of financial cycles. Indeed, financial elements played a critical role in all twentieth-century cycles. And, while it may be difficult to precisely separate out the exogenous and endogenous roles of the financial factors, the booms, credit crunches and busts were defining features of the fluctuations.⁷ What is different now is that the financial cycles co-mingle both domestic determinants of financial cycles and global determinants (BIS (2014)). For EM Asia, these global factors arguably are more important now.

Third, the increased integration with global financial markets introduces new sources of shocks to the economy, creating new challenges for central banks. In particular, interest rate developments outside the region and international financial dynamics more generally will have a greater impact on the region's domestic economy through cross-border channels. This raises the importance of central banks taking an international perspective and closely monitoring global financial market developments. Going forward, EM Asia faces new vulnerabilities as asset managers with deep financial pools play a greater role in determining international capital flows that influence domestic financial markets. On the one hand, asset managers who are focused on increasing value over the medium term can enhance growth prospects in EM Asia as they chase productive investments. On the other hand, the size of the funds available to asset managers relative to the size of financial markets in various EM Asian jurisdictions may create vulnerabilities. To the extent that asset managers herd, capital flows to EM Asian economies may become even more disruptive than in the past. And, to the extent that the incentives of asset managers to focus on short-term performance metrics distort investment strategies, EM Asian economies may face excessive volatility.⁸

Fourth, large-scale interventions by Asian monetary authorities in foreign exchange markets in the context of greater economic and financial integration of EM Asian economies in the global economy have had implications for credit and asset price booms (Filardo and Siklos (2013)). Another consequence of these interventions has been a massive expansion of central bank balance sheets in several jurisdictions, creating a number of significant risks for central bank finances and ultimately for central bank credibility.

In the rest of this section, we turn to the empirical record for these four implications in EM Asia. We look first at the macro-financial developments through the lens of the traditional monetarist perspective. We then explore the role of the domestic and global financial cycle in EM Asia by assessing the nexus between monetary developments and financial stability risks and the significance of monetary and financial spillovers. Finally, we consider the implications for monetary

⁷ See eg Borio and Lowe (2004) and Schularick and Taylor (2012).

⁸ For a model of the latter, see Morris and Shin (2014).

analysis of the active exchange rate management strategies of EM Asian central banks.

The decline of the traditional monetarist perspective

The quantity theory of money implies that money growth and inflation are proportionally linked in the long run. On these grounds, monetarists have argued that central banks need to steer monetary trends in order to achieve inflation control. A precondition for the usefulness of this approach is that there is a stable empirical relationship between the money stock and nominal income. This, in turn, requires that the velocity of money be stably related to the opportunity cost of holding money.

Indeed, the adoption of monetary targeting by a number of advanced economy central banks was predicated on the existence of such a stable relationship. However, such frameworks proved wanting as financial innovation gave rise to infrequent and unpredictable shifts in the velocity of money. As a consequence, monetary targeting had already been abandoned by most advanced central banks by the late 1980s as the monetary aggregates ceased to be reliable guides for monetary policy.⁹ In the subsequent move towards (explicit and implicit) inflation targeting, monetary aggregates have been progressively downgraded in most monetary policy frameworks in the advanced economies, also against the background of evidence suggesting that the money growth-inflation nexus has weakened due in large part to financial innovation.

As we have documented, emerging Asian economies have, over the past two decades, experienced a transition to low inflation environments accompanied by significant financial deepening and financial inclusion. The consequence for the usefulness of the monetary aggregates has been significant. Graph 8 documents the evolution over time of the relationship between the velocity of broad money and the opportunity cost of holding money in our nine Asian economies. The graph reveals that money demand in Asia has been unstable. In particular, the relationship between money velocity and the opportunity cost of holding money has been shifting in many countries. As a result, monetary aggregates have become less reliable indicators of future inflation over monetary policy horizons of one to two years. In light of these developments, as well as taking into account similar experiences elsewhere in the central banking world, it is no surprise that monetary targeting has become less attractive to EM Asian central banks. Annex Table 1 highlights the shift in monetary policy frameworks away from monetary targeting after the Asian Financial Crisis.

In order to assess the information content of money growth for future inflation over horizons that are relevant for the day-to-day conduct of monetary policy, we run standard forecasting regressions on quarterly data for nine EM Asian economies (China, Hong Kong SAR, Indonesia, India, Korea, Malaysia, Philippines, Singapore, Thailand). The forecasting regressions take the form

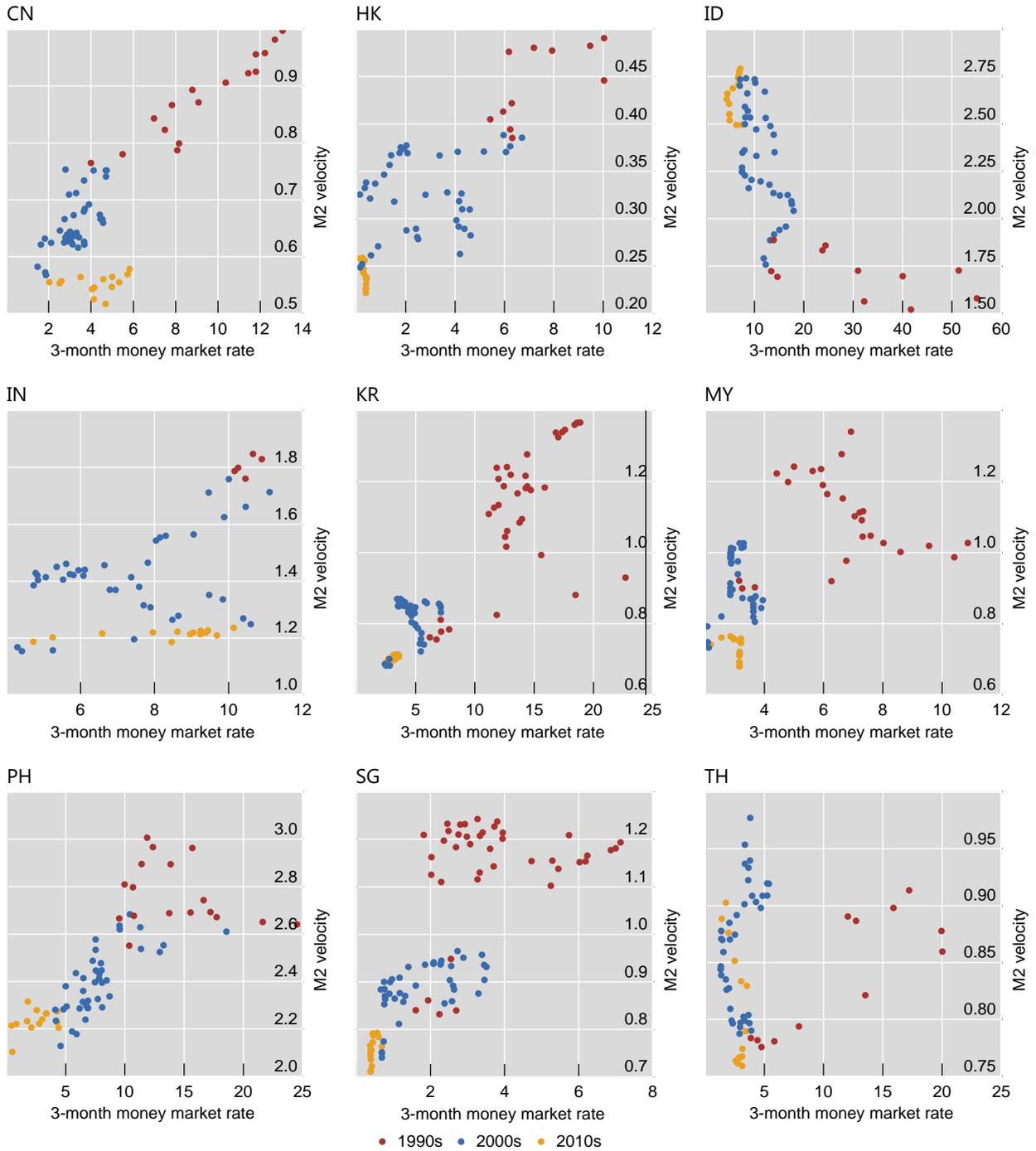
$$\pi_{i,t} = \alpha_i + \beta m_{i,t-k} + \gamma X_{i,t-k} + \varepsilon_{i,t} \text{ for } k=4,8,12 \quad (1)$$

⁹ The most famous quote on the demise of monetary targeting by many central banks at that time is from Gerald Bouey, the Governor of the Bank of Canada, who said "We didn't abandon monetary aggregates, they abandoned us!" For a more detailed discussion of advanced economy central banks' experiences with monetary targeting, see Mishkin (2000).

where π is the year-on-year inflation rate, m is broad money growth and X is a set of control variables including the output gap and the inflation rate. Both economy-by-economy and panel regressions with fixed effects are estimated. The panel regressions are run once for the full sample for which data are available, which varies across countries, and for the recent sample period starting in 2008. The results are shown in Table 1.

Shifting velocity

Graph 8



Sources: Bloomberg; Datastream; national data.

Overall, the findings confirm the notion that monetary aggregates have become an unreliable indicator of future inflation. For the individual economies, the information content of money growth is spotty and statistically and economically small. For the panel, while lagged money growth rates are significant at all horizons when the regressions are estimated over the full sample, the coefficients are insignificant and quantitatively close to zero over the more recent sample period. The reduced information content of monetary aggregates helps to account for the decision of many EM Asian central banks to abandon monetary targeting strategies in the course of the past two decades.

Money growth as a predictor of inflation¹

Table 1

Economy estimates	Lagged 4 quarters		Lagged 8 quarters		Lagged 12 quarters	
China	-0.02		-0.01		-0.22***	
Hong Kong SAR	-0.02		-0.10		-0.15**	
Indonesia	0.30***		0.06		0.06	
India	-0.13		0.05		0.09	
Korea	0.15***		0.24***		0.21***	
Malaysia	0.05**		0.03		0.01	
Philippines	0.20**		0.35***		0.16	
Singapore	0.03		-0.03		-0.08***	
Thailand	0.11***		0.02		-0.07	
Panel estimates	Full sample	2008–2013	Full sample	2008–2013	Full sample	2008–2013
Money growth	0.19***	-0.02	0.16***	-0.00	0.07**	0.01
Output gap	0.95***	0.28***	0.64***	-0.28**	0.11	-0.15**
Inflation	0.16***	-0.49***	-0.04	0.03	0.09**	0.20***
Adjusted R-squared	0.39	0.49	0.27	0.38	0.22	0.37

¹ Estimation of $\pi_t = \beta_0 + \beta_1 m_{t-i} + \beta_2 \tilde{y}_{t-i} + \beta_3 \pi_{t-i} + \varepsilon_t$ where π is headline inflation based on wholesale price index for India and on consumer price index for others; m is excess money growth by subtracting annual growth of real GDP from annual growth of M2; \tilde{y} is the output gap; i represents the indicated lagged period. Sample period of quarterly data varies according to economy. *** and ** indicate statistical significance at the 1% and 5% levels respectively.

Source: authors' calculations.

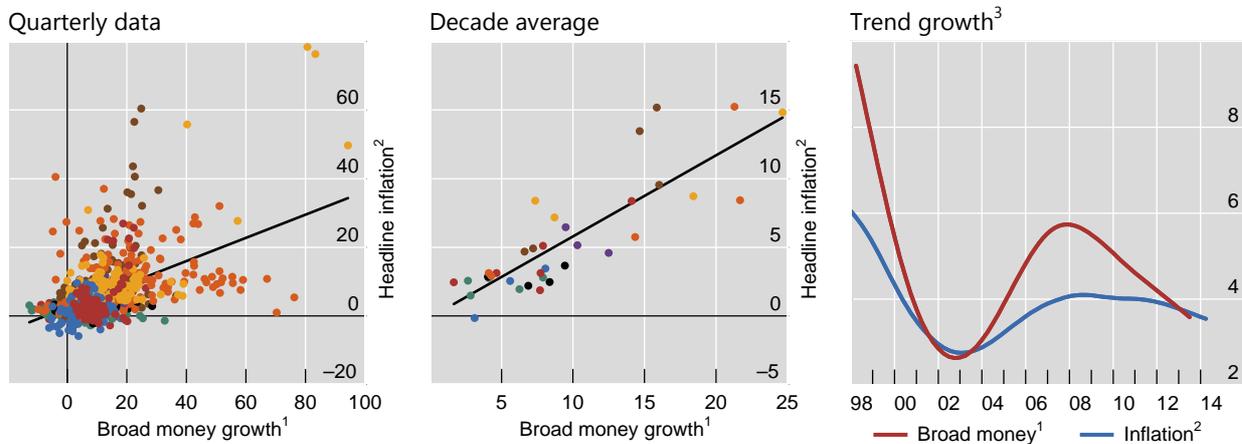
This notwithstanding, the long-run correlation between money growth and inflation appears to remain intact in Asian economies.¹⁰ Graph 9 shows that over long horizons, money growth and inflation co-move, as implied by the quantity theory. At the quarterly frequency (left-hand panel), money growth rates are highly volatile and only loosely correlated with inflation rates. But when looking at decade averages (middle panel), money growth and inflation rates show a positive and relatively tight linear relationship (though somewhat less than the one-to-one relationship suggested by the simple quantity theory). And, money growth and inflation trends (as measured by a Hodrick-Prescott filter) highly co-move. All this means that, while short-term developments of the monetary aggregates are not reliable guides for the conduct of monetary policy, central banks would be well advised to continue keeping an eye on long-term money growth trends as an indicator of long-run underlying inflation trends.

¹⁰ These relationships are consistent with those found in studies of economies outside EM Asia. See BIS (2007).

Money and price in EM Asia

In per cent

Graph 9



¹ Annual growth of M2 minus annual growth of real GDP. ² Annual growth rates; WPI for India, CPI otherwise. ³ HP filtered trend of annual growth.

Sources: Datastream; national data.

The rise of the financial cycle perspective

As the pre-crisis experience suggests, unduly loose monetary conditions need not show up in inflation; they may instead manifest themselves in growing financial imbalances. Traditional benchmarks and indicators for the build-up of financial imbalances may give cause for concern in this respect. Since 2007, credit-to-GDP ratios and real house prices in EMEs have increased by almost 40% (Graph 10, left-hand panel).

To be sure, rising credit-to-GDP ratios and house prices do not necessarily indicate that financial imbalances are building; they may also reflect financial deepening and inclusion and rising living standards. But the speed of the increase is more worrying. One way of assessing this is to look at credit-to-GDP gaps, ie the divergence of credit-to-GDP ratios from their underlying trends. These variables have a good track record in indicating brewing financial trouble;¹¹ as a result, they have been adopted as reference guides for the Basel III countercyclical capital buffer.¹² The average credit-to-GDP gap in EMEs is quite high, exceeding even the pre-Asian crisis level (Graph 10, right-hand panel). It is currently close to 10% - the level that, if applied mechanically, would call for Basel III countercyclical capital buffers to be imposed at their maximum.

One obvious question is whether such credit gap measures are appropriate for EMEs. The case against the use of these measures maintains that EMEs are engaged in more rapid financial deepening than can be captured by the trends. Many have comparatively low debt-to-GDP ratios. They have taken steps to strengthen their

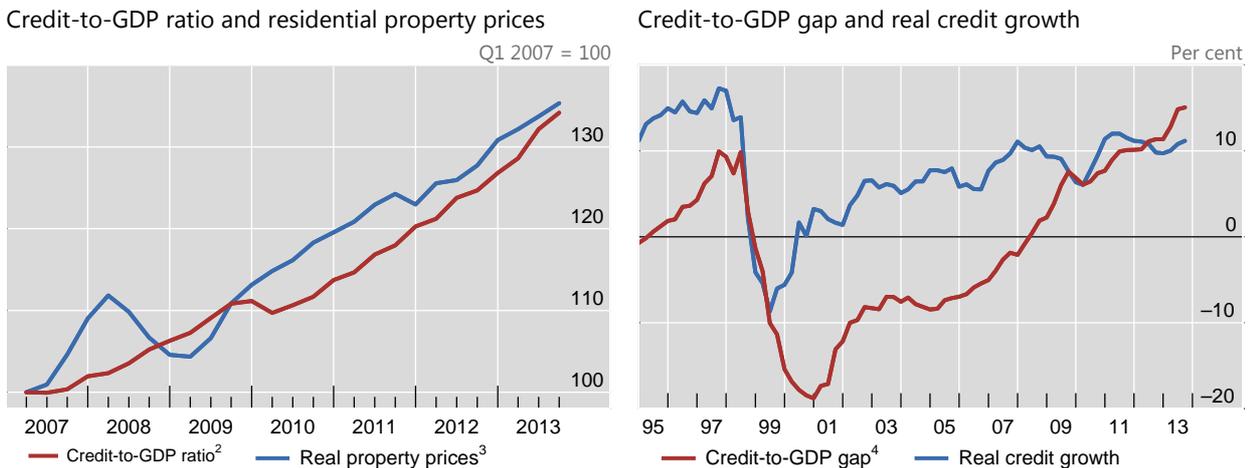
¹¹ See eg Borio and Lowe (2002), Borio and Drehmann (2009) and Drehmann and Juselius (2013).

¹² See Basel Committee on Banking Supervision (2010).

financial systems since the mid-1990s crises. And, more recently, they have relied extensively on macroprudential measures to contain risks. The alternative view suggests that indicators of financial risks were originally calibrated also for EMEs, which, in fact, had experienced more crises, and that the evidence indicates that the speed of credit expansion matters a great deal for the risk of financial distress.¹³

Private sector credit and residential property prices¹

Graph 10



¹ Simple average of China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. ² The index is based on the difference between quarter-on-quarter changes in nominal credit and quarter-on-quarter changes in four-quarter moving sum of nominal GDP. Bank credit to the private sector for the Philippines; total credit to the private sector otherwise. ³ Seasonally adjusted, quarterly averages; definitions may differ across economies. ⁴ The credit-to-GDP gap is the deviation of the credit-to-GDP ratio from a one-sided long-term trend. The smoothing parameter λ is 400,000.

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

Table 2 provides evidence on the performance of the credit-to-GDP gap in EMEs in comparison with the performance of the indicator in a larger sample of economies (including the advanced economies);¹⁴ non-Asian EMEs were also included in order to achieve a critical mass of crises for the analysis. The table shows the number of correctly predicted crises as well as the noise-to-signal ratio (the ratio of incorrectly predicted crises to correctly predicted crises) for three thresholds for the credit-to-GDP gap: two, six and 10. It is clear from the table that the signalling quality of the gap is nearly identical across the samples, in particular for lower thresholds. Importantly, more than 70% of the crises are correctly predicted in EMEs using these thresholds.¹⁵

¹³ See eg Drehmann et al (2011).

¹⁴ We are grateful to Mathias Drehmann for providing the results. The signal takes the value of 1 (is "on") if the credit-to-GDP gap exceeds a critical threshold; it is 0 (is "off") otherwise. A signal of 1 (0) is judged to be correct if a crisis occurs (does not occur) any time within the next three years. This allows the fraction of correctly predicted crises as well as incorrect calls (type II errors) to be calculated. The noise-to-signal ratio provides a useful summary statistic, as it is the ratio of type II errors over one minus the fraction of crises that were not called (type I errors). See Drehmann (2013) for more details on the analysis.

¹⁵ Six was one of the critical thresholds identified in the literature. See Borio and Drehmann (2009).

Performance of the credit-to-GDP gap as an early warning indicator¹

In per cent

Table 2

Threshold	Large sample (45 countries, 34 crises)		EMEs (24 countries, 11 crises)	
	Predicted	Noise-to-signal ratio	Predicted	Noise-to-signal ratio
2	85	51	82	56
6	79	32	73	39
10	71	21	55	32

¹ Fraction of correctly predicted crises. The noise-to-signal ratio is the ratio of type II errors (crisis signal issued, but no crisis occurred) over the fraction of predicted crises.

Sources: National data; BIS calculations.

Factoring in the global financial cycle perspective

Greater international integration of financial markets also means that global financial factors have had increasing relevance for domestic monetary analysis in EM Asian economies. Specifically, given the size and volatility of financial flows into their economies, EM central banks need to have a good understanding of the drivers of these flows, in order to be able to assess the potential impact of the global financial cycle and to take defensive measures in a timely way. One variable that appears to drive the global financial cycle is international investor risk aversion. A number of studies have shown that the US implied stock market volatility index (VIX), one such measure of risk aversion, displays a significant negative correlation with cross-border capital flows to emerging market economies (see eg Bruno and Shin (2013), Takats (2010) and Forbes and Warnock (2011), Rey (2013)). The levels of short- and long-term interest rates play an important role, too, as has been evident in the run-up to the tapering of the Federal Reserve's bond purchases. Swings in US rates are often seen as having a major impact on global rates, especially when they experience wide swings as in the global bond market crash of the mid-1990s.¹⁶

Importantly, the global financial cycle can affect financial conditions in EMEs through both quantity and price channels. The most prominent quantity spillover channel operates through capital flows. Before and after the crisis, capital flow dynamics have been shaped in particular by credit flows via cross-border bank credit and portfolio debt flows. Cross-border financial flows, or concerns about them, also give rise to price spillover effects in particular through induced changes in interest rates, shaping financial conditions in the economy more broadly. Specifically, EME central banks may wish to avoid large and volatile interest rate differentials so that short-term rates become implicitly tied to those of advanced economies.¹⁷ At the same time, due to the greater integration into the global

¹⁶ From a structural perspective, Eickmeier, Gambacorta and Hofmann (2014) show that the global financial cycle is driven by three common factors, which can be identified as credit supply, credit demand and monetary policy.

¹⁷ Such policy spillovers may be one driver of the persistent deviation of EM policy rates from standard benchmarks (ie a Taylor rule) that has emerged since the early 2000s (Hofmann and Bogdanova (2012)).

financial systems, long-term interest rates in EMEs have also become more closely tied to those in advanced economies (Turner (2014)).

To assess the relevance of the spillover channels for the nine Asian economies under investigation, we use simple panel regressions. For the quantity channels, we pursue an approach similar to Takats (2010); we model cross-border credit flows to EMEs as a function of GDP growth, the VIX and the interest rate differential against the United States using fixed effects panel techniques. We do the same for the analysis of cross-border credit growth using the BIS locational banking statistics and the growth in the stock of international debt securities issued by corporates from the BIS debt securities statistics (by nationality of the issuer), but add the spread of the three-month interest rate over the US three-month rate to the regression specification.¹⁸ Specifically, we estimate the following two equations:

$$\Delta q_{i,t} = \alpha_i + \beta_1 \Delta GDP_{i,t} + \beta_2 VIX_t + \beta_3 (i_{i,t} - i_{US,t}) + \varepsilon_{i,t} \quad (2)$$

where Δq stands for the year-on-year log change in cross border bank credit or the year-on-year log change in international debt securities by nationality of issuers, ΔGDP for domestic year-on-year real GDP growth (log change), the VIX is the implied stock market volatility index for the United States, i is the domestic three-month interbank rate and i_{US} is the US three-month interbank rate. The two equations are estimated on quarterly data with panel fixed effects over the two sample periods, 2000Q1 until 2013Q3, and a shorter sample period starting in 2008Q1 in order to check for any changes in the relationship over the crisis period.

Quantity spillover channels¹

Table 3

	Cross-border credit		International debt issued by non-bank corporates	
	2000-2013	2008-2013	2000-2013	2008-2013
Real GDP growth	1.58***	1.64***	0.60**	0.32
Short-term spread	0.22	0.80	-0.24	3.46***
VIX	-0.71***	-0.56***	-0.45***	-0.35***
R ²	0.26	0.35	0.18	0.48
Number of observations	494	206	500	212

¹ Panel estimation of $credit_t^i = \beta_0 + \alpha_0^i + \beta_1 rgdp_t^i + \beta_2 sprd_t^i + \beta_3 vix_t + \varepsilon_t^i$ where $credit$ is either annual growth of cross-border credit to non-bank sector of economy i or annual growth of international debt issued by non-bank corporates (by nationality) of economy i ; $rgdp$ is annual growth of real GDP; $sprd$ is the spread between 3-month interbank rate of economy i and that of the US; vix is the Chicago Board Options Exchange Market Volatility Index (VIX); i represents China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. ** and *** indicate statistical significance at the 5% and 1% levels respectively based on White cross-section standard errors.

Source: authors' estimations.

The equations are estimated by panel fixed effects for the nine Asian economies under investigation. Table 3 presents the estimation results. The following findings stand out. First, consistent with the findings of previous studies, the VIX is a highly significant driver of financial flow variables. An increase in the VIX

¹⁸ We also looked at specifications with the spread of the domestic long-term bond yield over the US 10-year bond yield, but found this specification to be inferior to the more parsimonious one including only the short-term interest rate spread, due to the high correlation between the two spreads. This implies that the short-term rate spread also captures in part the effects coming from the bond yield spread.

is associated with a sizeable and significant drop in both cross-border bank credit and in international debt securities issuance. Second, the interest rate spread vis-à-vis the United States is not significant in both equations. However, over the sample period starting in 2008, the interest rate spread has a very large and highly statistically significant coefficient in the international debt issuance equation, suggesting that interest rate differentials recently have gained considerable importance for debt flows.

For the assessment of the price spillover effects running via short- and long-term interest rates we estimate equations of the form:

$$\Delta i_{i,t} = \phi_i + \lambda \Delta i_{US,t} + \Gamma X_t + \zeta_{i,t} \quad (3)$$

which can be derived from the standard covered interest rate parity condition linking the change in the domestic interest rate (Δi_t) to the change in the US interest rate ($\Delta i_{US,t}$), where both 3-month rate and the 10-year bond yield are considered.¹⁹ X_t is vector of control variables, including the VIX as well as the change in domestic inflation and real GDP growth. In the case of the 10-year yield, also the change in the domestic 3-month rate is included as a control variable.

Equation (3) is again respectively estimated by panel fixed effects for our nine Asian economies and Table 4 shows the results for the three-month interest rate and the 10-year bond yield. A number of noteworthy findings stand out. First, the US interest rates are important drivers of domestic interest rate dynamics in Asian EMEs, with an increased importance over the more recent sample period. These findings strongly confirm the relevance of international price spillovers that go beyond the standard quantity spillovers assessed above. Second, the F-test of the significance of domestic variables in the respective interest rate equation strongly rejects the null that the coefficients are zero. This suggests that domestic rates react to a significant extent also to domestic variables, implying that a complete loss of monetary autonomy in the sense of Rey (2013) does not seem to be the case for EM Asia.

Price spillover channels	3-month ¹		10-year ²	
	2000-2013	2008-2013	2000-2013	2008-2013
US interest rate	0.39***	0.54***	0.56***	0.67***
Adjusted R-squared	0.15	0.25	0.37	0.32
F-statistics ³	11.32***	6.34***	24.34***	2.61**
Number of observations	500	212	472	212

¹ Panel estimation of $\Delta r3m_t^i = \beta_0 + \alpha_0^i + \beta_1 \Delta r3m_t^{US} + \beta_2 X_t^i + \varepsilon_t^i$, where Δ indicates quarter-on-quarter change; $r3m$ is 3-month interbank rate; X are domestic factors including annual growth of real GDP, headline inflation rate and VIX; i represents China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. *** and ** indicate statistical significance, respectively, at the 1% and 5% level based on White cross-section standard errors. ² Panel estimation of $\Delta r10y_t^i = \beta_0 + \alpha_0^i + \beta_1 \Delta r10y_t^{US} + \beta_2 X_t^i + \varepsilon_t^i$ where $\Delta r10y$ is quarter-on-quarter change in 10-year government bond yield; X are the variables listed in footnote 1 and domestic 3-month interbank rate. ³ F-test under the null hypothesis that coefficients of domestic factors, β_2 , equal zero.

Source: authors' estimations.

¹⁹ Estimating equations of this type have been widely used in the empirical literature on the policy trilemma in open economies (eg Obstfeld et al (2004) and Obstfeld (2014)).

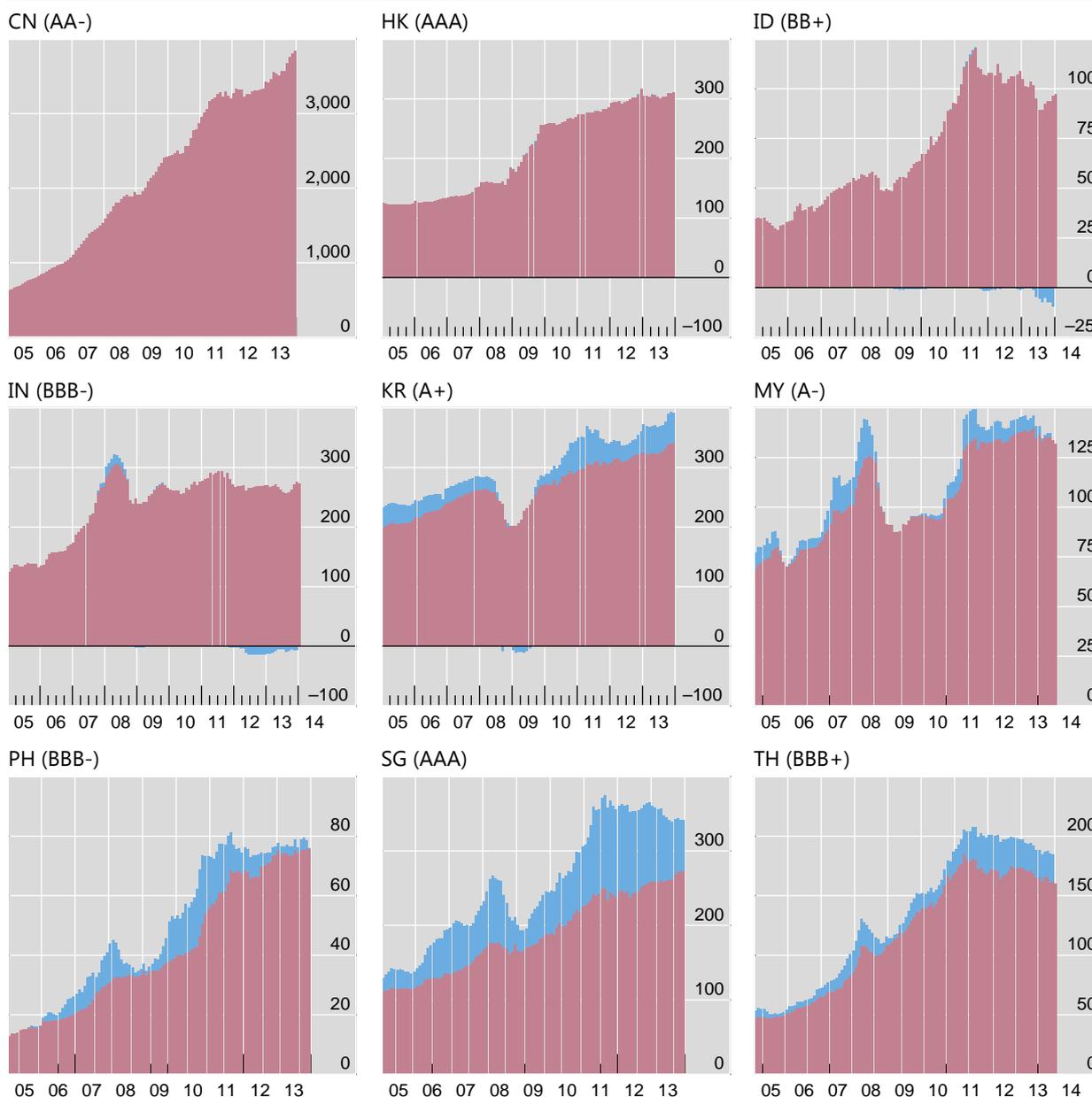
Foreign exchange rate management and quantitative aggregates in EM Asia

Large-scale FX intervention by EM Asian central banks also has important implications for monetary analysis through its effect on both central banks' and commercial banks' balance sheets. The extent of the interventions is illustrated in Graph 11. A strong upward trend in foreign exchange reserves is evident, with some

Foreign exchange reserves¹ and net forward positions²

In billions of US dollars

Graph 11



Standard & Poor's foreign currency long-term sovereign debt ratings are indicated in brackets.

¹ Official reserves excluding gold, in billions of US dollars. Includes SDRs and reserve positions in the IMF. ² Long positions in forwards and futures in foreign currencies vis-à-vis the domestic currency, minus short positions.

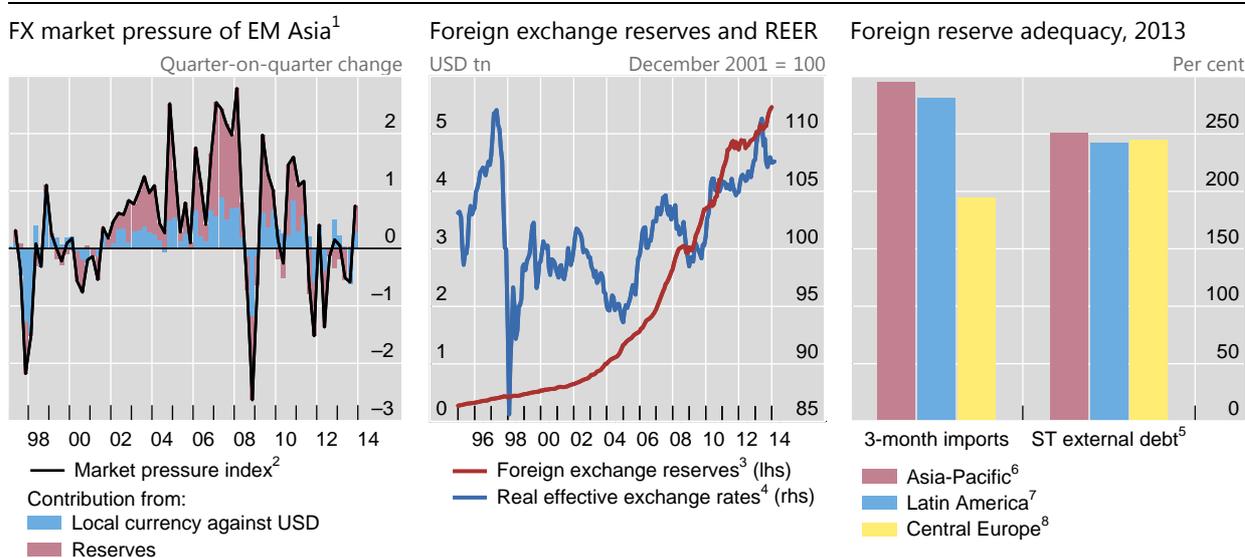
Sources: IMF, *International Financial Statistics*; IMF, *International Reserves and Foreign Currency Liquidity*.

economies rebuilding large stocks that were partially run down during the international financial crisis; this is the case for both long reserve positions as well as FX net forwards during the height of the international financial crisis.²⁰

The primary reasons for the persistent increase in exchange rate reserves have varied across time and across economies. One reason, especially for the period after the Asian Financial Crisis, has been the desire of emerging Asian economies to build up exchange rate reserve buffers to increase the resilience of their economies to external shocks. Another reason emphasises regional growth strategies based on leaning against exchange rate appreciation pressures to gain a competitive export advantage against the rest of the world, sometimes dubbed the Bretton Woods II view (eg Dooley et al (2009)).

Reserves and exchange rates

Graph 12



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 normalized change in nominal exchange rate against US dollar and ratio of normalized change in international reserves to narrow money. ³ Aggregate of listed economies. ⁴ Month-on-month percentage change of real effective exchange rates; simple average of listed economies. ⁵ 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 remaining maturity up to one year. ⁶ Simple average of Australia, China, Hong Kong SAR, Indonesia, India, Japan, Korea, Malaysia, New Zealand, Pakistan, Philippines, Singapore and Thailand. ⁷ Simple average of Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. ⁸ Simple average of the Czech Republic, Hungary and Poland.

Sources: IMF, *International Financial Statistics*; Datastream; national data; BIS consolidated banking statistics; BIS debt securities statistics.

Over the past decade, however, EM Asian central banks have increasingly argued that the motivation for the heavy exchange rate intervention has been to reduce exchange rate volatility by lopping off the tops and bottoms of the rate swings. Graph 12 (left-hand and middle panels) demonstrates that central banks have tended to intervene in the same direction as the movement in the nominal exchange rate. That is, when the nominal exchange rate is appreciating (eg positive

²⁰ See BIS (2010) for a more detailed analysis of the impact of the international financial crisis on emerging Asia.

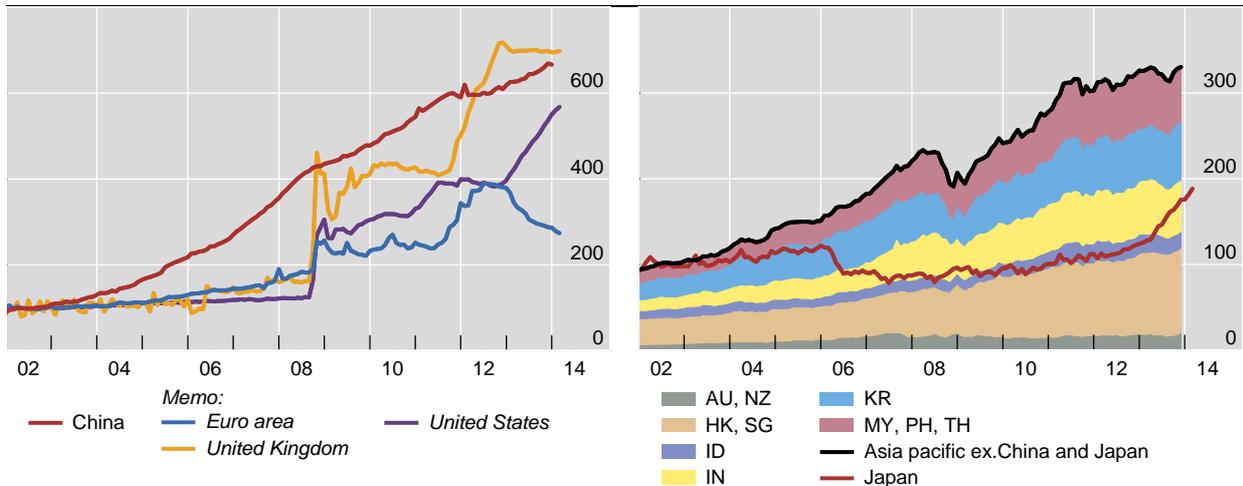
blue bars in the panel), central banks tend to intervene by buying foreign assets with domestic assets (eg positive red bars); when depreciating, the central bank tends to sell its holdings of foreign assets and buy domestic assets. Over the past few years, the interventions on the whole have been smaller than earlier in the crisis. This has been achieved in the context of relatively ample foreign reserves relative to the level of imports and short-term external debt. The difficulty of achieving this volatility-smoothing goal in real time arises from the complications associated with the ability to accurately measure the equilibrium exchange rate.

The difficulty of accurately measuring the equilibrium exchange rate also complicates the calibration of monetary policy strategies. If under- and over-valuations of exchange rates were readily known, the information value of quantitative measures of exchange rate reserve levels would be limited. However, in the absence of reliable measures of equilibrium exchange rates, the quantitative measures can provide valuable insights. Indeed, Filardo and Grenville (2012) argue that one potential metric for central bank success in pursuing volatility-reducing exchange rate dynamics in a symmetric way would be a trendless quantitative measure of exchange rate reserves (assuming it is consistent with levels that are prudent for precautionary purposes²¹). If done credibly over time, such an approach could counter oft-heard accusations of being a beggar-thy-neighbour policy choice.

Central bank total assets

Index; 2002 = 100

Graph 13



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

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

The sheer size of the exchange rate reserves in EM Asia opens up domestic financial stability risks, thereby underscoring the importance of tracking the magnitude of the stock of reserves and its implication for central bank balance sheets. Filardo and Yetman (2012) document the impact of foreign exchange reserve accumulation on the size of emerging Asian central bank balance sheets

²¹ See IEO (2012) for a detailed review of the policy issues associated with exchange rate reserve adequacy and alternative benchmarks.

during the early 2000s. Nearly all the expansion of EM Asian central bank assets over the past decade or so can be traced to foreign exchange interventions. The corresponding liabilities have also grown rapidly but economies have taken different approaches to sterilising the impact of increasing exchange rate reserves. The authors also highlight the risks created by the size and structure of EM Asian central bank balance sheets (Graph 13). It is important to note that central bank balance sheets are the counterpart to private financial sector balance sheets. As the central bank balance sheets grow large and change rapidly, private financial markets have to absorb those changes.

The response of the private financial markets to changes in central bank balance sheets is a key to understanding the implications for any particular economy. For example, in the short run, a rapid accumulation foreign reserves that are then sterilised by central bank bills tends to crowd out bank lending to businesses. Indeed, Cook and Yetman (2012) report evidence supporting this perspective. In addition, the build-up of central bank liabilities in the form of low-yielding deposits held at the central bank (ie central bank reserves) or central bank bills also contributes to risks. When risk appetite is low in an economy, the holdings of such low-yielding central bank liabilities, which are assets to the private banking system, may not be an issue. But in an economy with high risk appetite, private banks may be tempted to leverage up to increase their return on these 'lazy assets'.²² To do so, the banks would have to take on increasingly risky loans to increase their return on assets, with potentially adverse consequences for financial stability. Also, the larger the central bank balance sheets, the greater the role central banks play in financial sector intermediation. As central banks become big players, especially in thinly traded markets, pricing anomalies can arise and distort credit allocations.

One final risk associated with the size of central bank balance sheets resulting from the build-up of foreign exchange rate reserves is the carrying cost of these assets. The larger the reserves, the higher the carrying cost and the greater the potential for political economy knock-on effects. This risk to central bank independence is a particularly relevant concern for EM Asian central banks. As in the case of most EM central banks, they generally swap high-yielding assets for low-yielding ones. For example, they purchase US treasury securities and issue higher-yielding domestic currency central bank sterilisation bonds. Over time, this yield differential is a carrying cost that reduces central bank profits and, hence, the return of revenues to the general government. In addition, the currency mismatch between the assets and liabilities opens up the central bank in the short run to mark-to-market losses and, over time, actual losses that, again, adversely affect the bottom line of the central bank. While such operating losses and the prospects of negative balance sheet capital do not operationally affect the ability of central banks to achieve their policy goals, sizeable losses can tarnish a central bank's reputation and thereby jeopardise its policy credibility with the public and its independence within the general government.²³

²² For more on the "lazy assets" perspective, see Filardo and Grenville (2012), Filardo and Yetman (2012) and Gadanez et al (2014).

²³ See BIS (2013) for a more detailed discussion of the central bank governance issues associated with central bank finances.

For all the reasons highlighted in this section, the size of foreign exchange reserves and the size and structure of central bank balance sheets are quantitative measures that play a particularly important role in EM Asia because of its policy choice to augment interest rate control with exchange rate control. The configuration of exchange rates and interest rates alone do not provide clear guideposts for the type of risks that may arise. In contrast, the size of foreign exchange reserve positions, the associated increase in central bank balance sheets and the way in which central banks sterilise the foreign exchange purchases all shed light on the risks. These risks do not necessarily point to quantitative targets for these aggregates but they do suggest that prudent limits may be one way to mitigate the risks that may arise.

III. Implications for monetary policy frameworks

The evolving macro-financial landscape has been challenging for central bankers as they have had to adapt and refine their monetary policy frameworks. Given the multifaceted nature of the developments, we see the need for a diverse approach when evaluating the policy trade-offs and central bank mandates. In this respect, there is significant merit to considering a multi-pillar approach to monetary policy.

For EM Asia, a three-pillar approach may be appropriate.²⁴ The first pillar would focus on traditional short-term macroeconomic stability. The second pillar would address medium-term risks associated with, but not exclusively, financial stability. More generally, it would address low probability, high impact risks that are difficult to quantify with precision. The third pillar would address the special challenges arising from EM Asia exchange rate regimes.

The rest of this section spells out more details of this three-pillar approach. In addition to being motivated by the nature of the macro-financial environment, the three-pillar approach could be seen as having implications for the institutional design of both monetary policy committees and the staffs that support the committees.

Pillar 1: a traditional macroeconomic stability pillar

The first pillar is a traditional one reflecting the monetary policy trade-offs between short-term inflation and output dynamics at conventional policy horizons of one to two years. Typically, these concerns are cast in terms of a macroeconomic model characterised by an IS-type output equation and a Phillips curve specification for inflation dynamics. In terms of policy instruments, most of the central banks respond to the macroeconomic developments with short-term policy interest rates that, for the most part, are consistent with Taylor-type policy rules. For those EM Asian central banks that have adopted inflation targeting, this approach has generally been adopted within the dynamic stochastic general equilibrium (DSGE)

²⁴ This would be in contrast to the two-pillar approach of the ECB and the two perspectives approach of the Bank of Japan. Also see Brunnermeier (2014) for a recent discussion of the theoretical foundations of modern monetary analysis in the context of the ECB's traditional two pillar strategy.

class of models. In practice, however, EM Asian central banks deviate from the canonical approach to varying degrees.²⁵

As noted above and documented in Annex Table A1, the role of monetary aggregates has declined over time and today typically is much diminished. EM Asia inflation reports do pay some attention to the development of monetary aggregates, but the emphasis is secondary at best. Some exceptions do exist. China still targets M2 and the developments of this broad monetary aggregate are closely followed by private sector analysts. In part, China still uses its reserve requirement ratio as a policy tool to influence liquidity conditions in financial markets which, in turn, influence the pace of credit and output growth. The Philippines also places emphasis on overseas remittances as a factor affecting consumption behaviour.

More generally, the analysis of monetary aggregates in Section II indicates that the aggregates still have a role to play, not in terms of short-term factors determining output and inflation dynamics but in terms of longer-term swings. These longer-term swings provide some information about the extent to which consumers and firms may be credit-constrained and about the general availability of liquidity. Going forward, renewed interest in modelling financial sector interactions with the macroeconomy may once again elevate the role of the quantitative aggregates in the conduct of monetary policy but we are still far from forging a new consensus on this front.

Pillar 2: a financial stability-oriented monetary policy pillar

The second pillar addresses the gap between monetary policy frameworks narrowly focused on price stability and frameworks that include a meaningful role for financial stability. Indeed, the Asian Financial Crisis and the spillovers of the International Financial Crisis to EM Asia have underscored the need to better integrate financial stability considerations into monetary policy frameworks. Questions remain about how to operationalise this integration, even though it has long been recognised in the region that financial stability is essential for lasting price stability.

A new consensus is emerging with regard to how to address a range of operational and conceptual issues. On the operational side, the question of how EM Asian central banks should respond to credit and asset price booms and busts is a central concern. The regional central banks have augmented their use of traditional monetary policy tools (eg policy interest rates, reserve requirements etc) with macroprudential and capital flow management tools. Graph 14 shows that EM Asia stands out in the use of macroprudential policies, many of which pre-date the latest set of crises.²⁶ However, the evidence about the effectiveness of these tools so far suggests that macroprudential tools, such as loan-to-value ratios and counter-

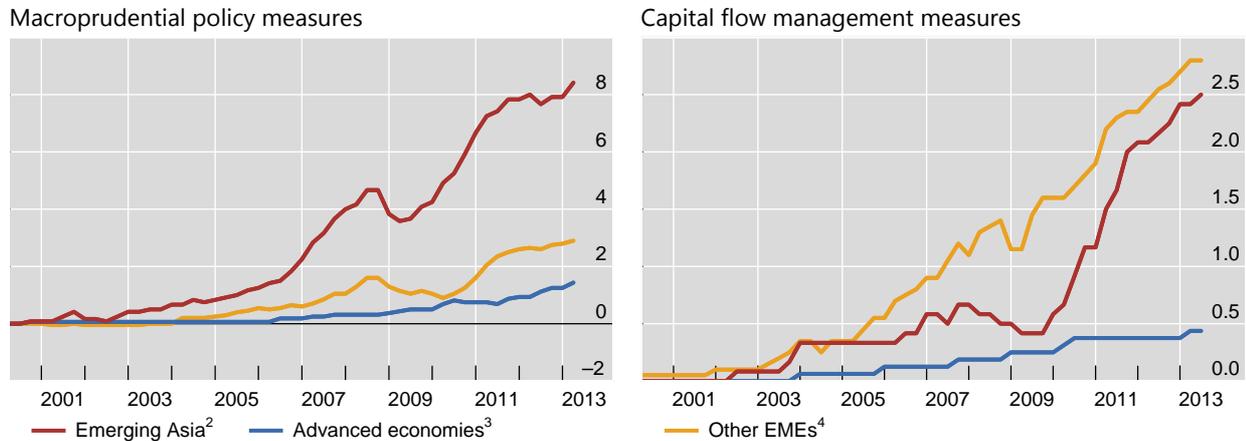
²⁵ While many have moved away from monetary targeting, it is perhaps questionable whether many have moved to a canonical version of inflation targeting, at least if by that term one means the 'Svensson variety' (see eg Svensson (2010)). Many are targeting inflation, but do so in ways that trade off inflation concerns with other policy concerns such as domestic financial stability and exchange rate stability. Central bank mandates are generally seen as sufficiently flexible to include financial stability, even if it is not explicit.

²⁶ Also see Central Bank Governance Group (2011) for further details about cross-country experiences.

cyclical capital buffers, may act more as complements to, rather than substitutes for, policy rate settings.

Index of macroprudential and capital flow management policies¹

Graph 14



¹ An increase indicates tightening of the policy. Simple average of the listed economies. ² China, Chinese Taipei, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Mongolia, Philippines, Singapore, Thailand and Vietnam. ³ Australia, Austria, Canada, Estonia, Finland, Ireland, Latvia, Netherlands, New Zealand, Norway, Slovakia, Spain, Sweden, Switzerland, United Kingdom and the United States. ⁴ Argentina, Brazil, Bulgaria, Chile, Colombia, Croatia, Hungary, Israel, Kuwait, Lebanon, Mexico, Nigeria, Peru, Poland, Romania, Russia, Saudi Arabia, Serbia, Turkey and Uruguay.

Source: L Zhang and E Zoli, "Leaning against the wind: macroprudential policy in Asia", *IMF Working Paper*, no 14/22.

On the conceptual side, central banks are asking how best to shift their traditional macroeconomic perspectives towards a more fully integrated macro-financial perspective. This requires a wholly new set of models with which to characterise the policy trade-offs. And, while our understanding of the traditional short-term monetary policy trade-offs is much further advanced after decades of academic and policy research, the bodies of research on financial stability and the nexus are still in their infancy. More study is needed and many promising lines of research are already in train.

Over time, as the nexus between financial stability and monetary policy becomes better understood, their integration is likely to generate better financial stability, price stability and macroeconomic stability outturns. The immediate challenge facing central banks is how to navigate the risks based on what we already know and what we don't know. Most EM Asian central banks have cleared the first conceptual hurdle, namely, recognising that central banks have a role and need to be pro-active.

In addition, EM Asian central banks are aware of the link between monetary policy and the financial cycle. This means tracking financial stability vulnerabilities not only at the micro level but also at the macro level through the monitoring of broad monetary and credit aggregates, with particular attention to house price dynamics. At a practical level, this has meant adopting a flexible policy horizon over which inflation returns to target and output returns to the steady state. As leverage builds up, debt levels become elevated and risk-taking behaviour appears excessive, policy rates may need to lean against the boom in a pro-active way. This means that the conventional one to two-year horizon associated with pillar one should be relaxed when pillar two concerns grow.

A few caveats are worth highlighting. First, the stretching of the policy horizon does not suggest an abandonment of the inflation target. Rather it means that the cost-benefit analysis associated with pillar one has to be jointly considered with the cost-benefit analysis of pillar two.

Second, the nature of the risks associated with pillar two should be thought of in a different way than those of pillar one. In pillar one, the balance of risks is of the more conventional type captured in econometric modelling and is implicit in the practice of generating monetary policy fan charts. The risks associated with pillar two might be best thought of as low probability, high impact risks that are difficult to calibrate with conventional modelling techniques. These risks may call for considerable judgment and “thinking outside the box”. Monetary policymaking under such conditions is a challenge. Some modelling efforts have been made along these lines (see for example, Filardo (2011)). The results from these models appear consistent with the view that financial cycles are a permanent part of the policy environment. This suggests that swings up and down are likely and that monetary policy can influence the amplitude and likelihood of extreme boom-bust behaviour. One implication is that central banks should respond to the rise in the tail risks more symmetrically than in the past by leaning more heavily during the boom phase as tail risks rise and to easing less aggressively as tail risks recede.²⁷

Based on recent research, credit-to-GDP gaps and other quantitative measures of the financial cycle are important indicators with which to assess pillar two risks. Of course, each economy would have to be judged according to the specifics in their jurisdictions. However, in dynamic, emerging market economies, where some of the financial deepening and financial inclusion is an essential part of the transition to becoming a developed economy, it can be difficult to correctly interpret these credit-to-GDP gaps.

For EM Asia, the growing openness of their economies to both trade and capital flows also raises the importance of pillar two concerns. As we have seen in the past two decades, swings in the global financial cycle have had important impacts on EM Asian economies. Capital flows in particular matter a great deal for the financial cycle. Periods of strong capital inflows tend to reinforce economic overheating and asset price booms, while periods of strong capital outflows tend to represent strong economic and financial headwinds. In addition, these flows influence the fragility of the economies, leading in some cases to large currency mismatches and unsustainable domestic credit expansion. In terms of pillar two, the likelihood of a low probability, high impact (ie very disruptive) boom-bust cycle is more likely, the wider the swings in capital flows.

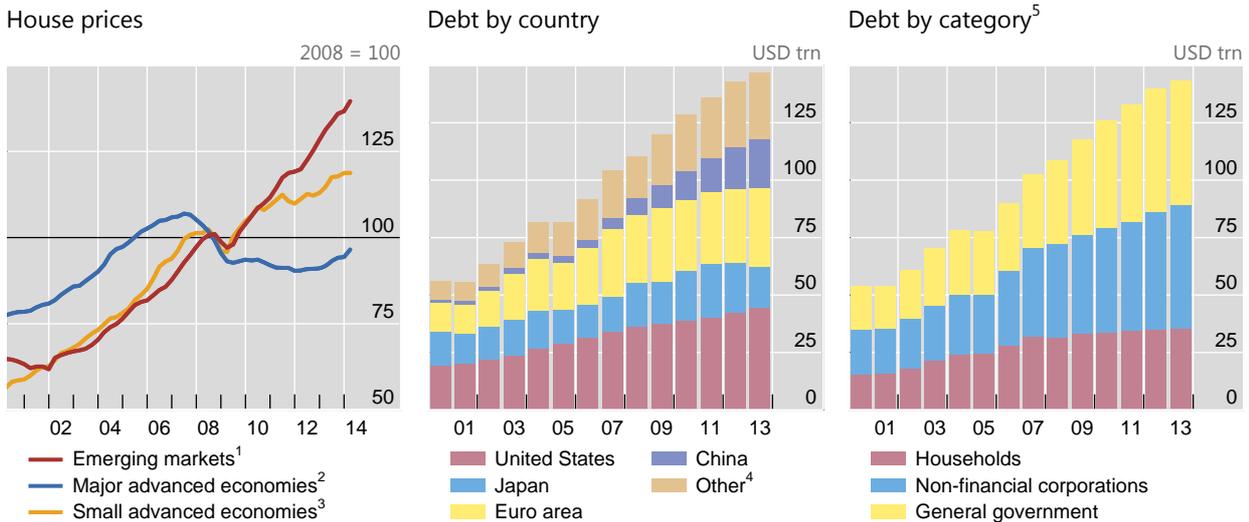
Practically, the impact of the global financial cycle on EM Asian economies may call for, under pillar two, more pro-active monetary policy responses than under pillar one alone. In recent years, global risk-on and risk-off behaviour has been a source of capital flow volatility. Even when inflation pressures are subdued, pillar two would argue for tighter monetary and credit conditions during risk-on periods. Measuring both domestic funding sources and cross-border funding sources allows central banks to track the extent to which the policy levers need to be adjusted. This type of pillar two trade-off would be relevant in the case of monetary policy

²⁷ See Caruana et al (2014) on this lesson from the recent financial crisis.

spillovers from the advanced economies onto EM Asia (see Chen et al (2013)). Graph 15 also highlights the potential role of credit and debt dynamics outside EM Asia, especially in the context of worrisome house price trends. These external conditions may raise the risk of disruptive crises that EM Asian central banks may want to monitor very closely and prepare to respond to in the case the risks materialise.

House prices and debt

Graph 15



¹ Simple average of Brazil, China, Colombia, Hong Kong SAR, Indonesia, Korea, Malaysia, Mexico, Peru, Singapore, South Africa, Thailand. ² Simple average of euro area, Japan, United Kingdom and United States. ³ Simple average of Australia, Canada, Denmark, Norway, Sweden and Switzerland. ⁴ Sum of Argentina, Brazil, Chile, China, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ⁵ Sum of total debt for Argentina, Australia, Brazil, Canada, China, India, Indonesia, Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey. ⁵ Sum of the economies listed in the centre panel.

Sources: IMF *World Economic Outlook*; OECD; national data.

Pillar 3: an exchange-rate-management-oriented pillar

Given that the various EM Asian economies have adopted actively managed exchange rate regimes, how should such concerns be integrated in their monetary policy frameworks? By and large, the central banks have focused on regimes which aim to lop off the tops and the bottoms of the exchange rate swings that would materialise without heavy exchange rate intervention. This pillar would explicitly reflect this policy objective and the special trade-offs it poses for both macroeconomic stability and financial stability.

From a conceptual point of view, this third pillar is an attempt to address the elusive notion of currency misalignments. As Engel (2011) has argued, currencies can deviate for considerable periods of time from their fundamental, or equilibrium, exchange rates. Such deviations can create important resource misallocations over time, such as those issues associated with Dutch Disease. And this possibility could call for central banks to lean against such misalignments if price stability, as characterised in pillar one, was not at risk.

It is important to point out that such a policy concern would not dictate exchange rate targeting per se. Rather, a central bank would factor misalignment concerns into its calibration of the desired speed for achieving price and output

stability. Moreover, uncertainties about the measurement of the equilibrium real exchange rate would also influence the extent to which the central bank would lean against the misalignment. The greater the uncertainty, the smaller the extent of the leaning. This would reduce the risk that spurious measures of misalignment would result in volatile policy actions. In the extreme case in which mismeasurement risk is particularly high, central banks might take a target band approach. Within a given range, the central bank would largely ignore the exchange rate fluctuations and let them float freely with little to no foreign exchange rate intervention activity. However, once outside the range, the central bank would put increasing weight on the misalignment of the exchange rate, even if inflation and output were well-behaved at conventional forecast horizons.²⁸

From a practical policy point of view, leaning against currency misalignments entails using the balance sheet of the central bank to intervene in foreign exchange rate markets. This means accumulating foreign currency reserves when exchange rates are considered sufficiently overvalued and decumulating reserves when sufficiently undervalued. If the misalignment pressures are broadly symmetric over time, this suggests that the size of the foreign currency reserve accumulation should provide some guidance about the equilibrium exchange rate. If central banks find themselves always intervening on one side of the market, the trend in foreign reserve accumulation would signal the likelihood that estimates of the equilibrium exchange rate need to be reconsidered.

This suggests that the asset side of a central bank's balance sheet is an important quantitative variable to track, more so than the monetary aggregates. If the central bank were to drain the excess liquidity created by foreign exchange purchases via reserve requirements, then the monetary aggregates would be a useful metric. However, to the extent that it uses central bank securities to drain the liquidity – and those liabilities are not included in the monetary aggregates – the asset side of the balance sheet would be a more accurate measure of the extent of the policy miscalibration. The size of the balance sheet assets would also provide an indication of the inflationary and financial stability risks highlighted in Section II.

This third pillar might also suggest that central banks interested in leaning against exchange rate misalignments should target a given sizes for their respective balance sheets. Assuming that misalignment pressures are symmetric over a sufficiently long period of time, then the accumulations and decumulations of foreign reserve assets would eventually cancel each other out. One measure of achieving this outturn is a trendless stock of foreign reserve assets. In the case of EM Asia, given the current stock of these assets, this would suggest a relatively trendless size of central bank balance sheets. Of course, there could be some drift over time as views about the appropriate level of exchange rate reserve adequacy changes.²⁹ But net of those changes, the size of the balance sheet should remain roughly stable, if the active exchange rate policy is calibrated appropriately.

Finally, pillar three would also cover trade-offs between the need for internal versus external adjustment. Central banks have the option to vary the degree to

²⁸ For more details on this approach, see Filardo et al (2011).

²⁹ The decision about the appropriate level of foreign reserve assets, that is foreign reserve adequacy, would include consideration of the carrying costs of those reserves. See Genberg et al (2005) and IEO (2012) for a general discussion of these issues.

which they lean against exchange rate movements. In the extreme, they could choose not to intervene and let the exchange rate freely float. So, in the case of particularly strong capital inflow pressures, one option would be to pursue a tighter monetary policy stance and to allow greater exchange rate flexibility, thus letting the exchange rate appreciate. This could foster a sense of two-way risk in markets which, if strong enough, would reduce the incentives for carry trades. However, this option would have to be weighed against the risk of extrapolative exchange rate expectations, which could lead to prolonged exchange rate appreciation away from the equilibrium level that, in turn, would damage the real economy by driving otherwise viable firms in the tradable sector out of business. Another option would be to tighten and to resort to capital flow management tools. It has been argued that these measures might provide greater short-term insulation from international spillovers. But experience suggests that these tools lose their effectiveness over time. They could also be counterproductive if they encouraged undue delay of necessary policy rate adjustments. In both cases, quantitative measures of capital flows, and the funding conditions driving them, would help in assessing the extent of these risks.

IV. Conclusions

EM Asian central banks have faced considerable changes in the macro-financial landscape over the past decades. In addition to experiencing home-grown and foreign-born crises, they have also been affected significantly by globalisation trends. These developments have led to a shift away from the traditional monetarist approach to monetary policy, which was dominant in the pre-Asian Financial Crisis period. Just as we saw in the advanced economies in the 1970s and 1980s, financial liberalisation, financial inclusion and deepening increased velocity instability. This development made it much harder to rely on short-term monetary targeting for achieving macroeconomic stability. However, it is still the case that there is an enduring, though imprecise, longer-term relationship between the monetary aggregates and macroeconomic outturns. We conclude from this evidence that it is too early to completely discard monetary analysis based on the monetary aggregates; it is nonetheless important that such analyses are more nuanced and focus on the information content captured in the medium-term trends.

Past crises have also highlighted a number of central banking challenges. The crises have shed light on the growing importance of the financial cycle, particularly the global financial cycle, for EM Asia. Central banks in the region have been grappling with the issue of how best to address financial stability concerns. With respect to monetary policy, EM Asian central banks have been facing the difficult task of integrating financial stability concerns into monetary policy frameworks. And, while they have made considerable progress, there is certainly more to do. One difficult hurdle to further progress has been the fact that these are early days in our understanding of the nexus between financial stability and monetary policy. More research and policy experiences will eventually give EM Asian central bankers, and others, a better understanding of the relevant costs and benefits of the various options.

At this point in time, a few broad lessons seem to be emerging about the way forward. First, with respect to inflation objectives, central banks need to be flexible

with respect to the time horizon over which inflation objectives are achieved when financial stability concerns arise. Second, central banks need to be more pro-active in leaning against financial booms and to ease less aggressively than in the past during balance sheet recessions. In other words, central banks need to respond more symmetrically to tail risks over the financial cycle. Third, central banks should not rely too heavily on macroprudential and capital management tools as substitutes for monetary policy actions; the evidence suggests that they are effective substitutes over short horizons but these tools are best thought of as complements over the medium- and long-terms; policy rates and the configuration of exchange rates are the first line of defence against macroeconomic and external imbalances.

As noted earlier, the exchange rate policies in EM Asia have had important implications for monetary policy and financial stability. In the post-Asian Financial Crisis period, active management of exchange rates has led to a massive accumulation of foreign exchange reserves and a corresponding expansion of EM Asian central bank balance sheets. This expansion has been accompanied by price and financial stability risks, which have built up slowly over time. While we do not deny the attractiveness of this exchange rate regime as a means of insulating EM Asia from the vagaries of the global financial cycle, we do see merit in the case for avoiding ever-increasing international assets (relative to GDP and some other conventional reserve adequacy metrics) on the balance sheets of the central banks.

Finally, all these factors suggest that monetary policy frameworks in EM Asia are still a work in progress, as central banks respond to powerful macro-financial trends. We argue that one way forward for EM Asia is to adopt, formally or informally, a three-pillar approach to monetary policy. As a conceptual framework, it would highlight the big challenges and trade-offs facing EM Asian central banks beyond those associated with narrow inflation targeting. This approach might also have implications for the institutional design of central banks, especially for the appropriate structure of monetary policy committees and for the departmental structure of central banks' staffs. This approach may also have more far-reaching institutional implications given the evidence of monetary spillovers across national borders. The international perspective may argue for greater central bank cooperation. In the case of EM Asia, the success of the Chiang Mai Initiative Multilateralisation and the establishment of the ASEAN+3 Macroeconomic Research Office (AMRO) may offer lessons on the way forward. We are cognisant that this three-pillar approach is not without its own risks. One important risk is that by trying to juggle three pillars, the attention of policymakers may be diverted from the primary objectives to those of secondary importance. Institutional efforts to prevent such an outturn would be a very important factor affecting the desirability and effectiveness of this multi-pillar approach.

References

Bank for International Settlements (2007): *77th Annual Report*, June.

Bank for International Settlements (2010): "The international financial crisis and policy challenges in Asia and the Pacific", *BIS Papers*, no 52, July.

Bank for International Settlements (2013a): "Who is issuing international bonds denominated in emerging market currencies?", *BIS Quarterly Review*, December 2013.

Bank for International Settlements (2013b): "Central bank finances", *BIS Papers*, no 71, April.

Bank for International Settlements (2014): *84th BIS Annual Report*, June.

Basel Committee on Banking Supervision (2010), *Guidance for national authorities operating the countercyclical capital buffer*, December 2010.

Borio, C (2004): "Securing sustainable price stability: should credit come back from the wilderness?", *BIS Working Papers*, no 157, July.

Borio, C and M Drehmann (2009): "Assessing the risk of banking crises - revisited", *BIS Quarterly Review*, March 2009.

Borio, C and P Lowe (2002): "Assessing the risk of banking crises", *BIS Quarterly Review*, December.

Brunnermeier, M (2014): "Monetary analysis: price and financial stability", presentation at the ECB Forum on Central Banking, 26 May.

Bruno, V and H-S Shin (2013): "Capital flows and the risk-taking channel of monetary policy", *Griswold Center for Economic Policy Studies Working Paper*, no 237b, June.

Caruana, J (2013): "Addressing risks to financial stability", speech at the 49th SEACEN Governors Conference and High-level Seminar, Kathmandu, Nepal, 21 November.

Caruana, J, A Filardo and B Hofmann (2014): "Post-crisis monetary policy: balance of risks", in *Monetary Policy after the Great Recession* (ed Javier Valles), Funcas Social and Economic Studies and available at <http://www.funcas.es/Publicaciones/Detalle.aspx?IdArt=21404>.

Central Bank Governance Group (2011): "Central bank governance and financial stability", *Study Group Report*, May.

CGFS (2014): "EME banking systems and regional financial integration", *CGFS Publications*, no 51, March.

Chen, Q, A Filardo, D He and F Zhu (2013): "International spillovers of central bank balance sheet policies", *BIS Papers*, no 66, pp 220–64; an updated version of that paper was presented at the 2013 Bank of Canada International Research Conference and available at the Bank of Canada's website.

Chung, K, J-E Lee, E Loukoianova, H Park and H-S Shin (2014): "Global liquidity through the lens of monetary aggregates", *IMF Working Paper*, no 14/9, January.

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

Dooley, M, D Folkerts-Landau and P Garber (2009): "Bretton Woods II still defines the international monetary system", *NBER Working Papers*, no 14731, February.

Drehmann, M (2013): "Total credit as an early warning indicator for systemic banking crises", *BIS Quarterly Review*, (June).

Drehmann, M, C Borio and K Tsatsaronis (2011): "Anchoring countercyclical capital buffers: the role of credit aggregates", *BIS Working Papers*, no 355, November.

Drehmann, M and Juselius, M (2013): "Evaluating early warning indicators of banking crises: satisfying policy requirements", *BIS Working Papers*, no 421, August.

Eickmeier, S, L Gambacorta and B Hofmann (2014): "Understanding global liquidity", *European Economic Review*, vol 68, May.

Eckstein, O and A Sinai (1986): "The mechanics of the business cycle in the postwar era", in *The American Business Cycle*, NBER.

Engel, C (2011): "Currency misalignments and optimal monetary policy: a reexamination", *American Economic Review*, October.

Filardo, A (2011): "The impact of the international financial crisis on Asia and the Pacific: highlighting monetary policy challenges from a negative asset price bubble perspective", *BIS Working Papers*, no 356, November.

Filardo, A (2012): "Ensuring price stability in post-crisis Asia: lessons from the recovery", in *The Implementation of Monetary Policy: Lessons from the Crisis and Challenges for the Years to Come*, The SEACEN Centre (also *BIS Working Papers*, no 378, April).

Filardo, A and H Genberg (2010): "Targeting inflation in Asia and the Pacific: lessons from the recent past", in *Twenty years of inflation targeting: lessons learned and future prospects*, Cambridge University Press.

Filardo, A, G Ma and D Mihajjek (2011): "Exchange rate and monetary policy frameworks in EMEs", *BIS Papers*, no 57, October.

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

Filardo, A and P Siklos (2013), "Prolonged reserves accumulation, credit booms, asset prices and monetary policy in Asia", BOFIT Discussion Papers 5-2013, March.

Filardo, A and J Yetman (2012): "Key facts on central bank balance sheets in Asia and the Pacific", *BIS Papers*, no 66, September.

Forbes, K and F Warnock (2011): "Capital flow waves", *Monetary Authority of Singapore Macroeconomic Review*, X(2), October.

Gadanecz, B, Mehrotra, A and M Madhusudan (2014): "Foreign exchange intervention and the banking system balance sheet in emerging market economies" *BIS Working Papers*, no 445, March.

Hofmann, B and B Bogdanova (2012), "Taylor rules and monetary policy: a global "Great Deviation"?", *BIS Quarterly Review*, September 2012.

IEO (2012): "International reserves: IMF concerns and country perspectives", *Independent Evaluation Office of the International Monetary Fund (IEO) Evaluation Report*.

Kamin, S, P Turner and J Van't Dack (1998): "The transmission mechanism of monetary policy in emerging market economies: an overview", *BIS Policy Papers*, no 3, January.

Kim, H-J, H-S Shin and J Yun (2013): "Monetary aggregates and the central bank's financial stability mandate", *International Journal of Central Banking*, January.

- McCauley, R, C Upper and A Villar (2013): "Emerging market debt securities issuance in offshore centres", *BIS Quarterly Review*, September.
- Mizen, P, F Packer, E Remolona and S Tsoukas (2012): "Why do firms issue abroad? Lessons from onshore and offshore corporate bond finance in Asian emerging markets", *BIS Papers*, no 401, December.
- Morris, S and H-S Shin (2014): "Risk-taking channel of monetary policy: a global game approach", *Princeton University working paper*, January.
- Obstfeld, M (2014): "Trilemmas and tradeoffs: living with financial globalization", paper presented at the 13th BIS Annual Conference, 27 June 2014, Lucerne, Switzerland, June.
- Obstfeld, M, J Shambaugh and A Taylor (2005): "The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility," *Review of Economics and Statistics*, vol. 87(3), August.
- Reinhart, C and M-B Sbrancia (2011): "The liquidation of government debt", *NBER Working Paper*, no 16893, March.
- Rey, H (2013): "The global financial angle and monetary policy independence", proceedings of the Federal Reserve of Kansas City Jackson Hole Symposium, August.
- Schularick, M and A Taylor (2012): "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870-2008", *American Economic Review*, vol 102(2), April.
- Shin, H-S and L Zhao (2013): "Firms as surrogate intermediaries: evidence from emerging economies", ADB Working Paper, December.
- Stein, J (2013): "Overheating in credit markets: origins, measurement, and policy responses", speech delivered at the research symposium sponsored by the Federal Reserve Bank of St. Louis "Restoring household financial stability after the Great Recession: why household balance sheets matter", St. Louis, Missouri, 7 February.
- Svensson, L (2010): "Inflation targeting", in *Handbook of Monetary Policy* (eds B Friedman and M Woodford), Elsevier BV.
- Takáts, E (2010): "Was it credit supply? Cross-border bank lending to emerging market economies during the financial crisis", *BIS Quarterly Review*, June.
- Turner, P (2014): "The global long-term interest rate, financial risks and policy choices in EMEs", *BIS Working Papers*, no 441, February.
- World Bank (2013): "Recent developments in local currency bond markets", October (www.g20.org/load/783687600).
- Zhang, L and E Zoli (2014): "Leaning Against the Wind: Macroprudential Policy in Asia", *IMF Working Paper*, no WP/14/22, February.

Institutional frameworks for monetary policy				Annex Table A1	
	IT?	Targeting arrangement	Key policy rate	Operating target	1997 operating/intermediate targeting ¹
China	No	M2 growth targets: 13% in 2014	1-year deposit & loan reference rates	Excess reserves as a reference	M1 and M2
Hong Kong SAR	No	Currency board: USD/HKD target range HKD 7.75 – 7.85	USD/HKD spot rate	USD/HKD convertibility zone	USD/HKD spot rate
India	No ²	Multiple objectives: price stability understanding - containing the perception of inflation in the range of 4.0-4.5% so that an inflation rate of 3.0% becomes the medium term objective	1-day repo rate; reverse RP rate = RP rate less 100 bps	Weighted average overnight call money rate	M3
Indonesia	Yes, 2000	Inflation targeting: 4.5±1% year-on-year CPI inflation for 2014	BI rate (= target rate for 1-month SBI)	1-month SBI rate	M0, target range for real effective FX
Korea	Yes, 1998	Inflation targeting: 2.5 – 3.5% range for 12-month change in CPI during 2013-15	Bank of Korea base rate	O/N call rate	M2 and MCT (=M2 + CDs+money in trusts)
Malaysia	No	Macroeconomic stability 6 – 8 quarters ahead	Overnight policy rate	O/N interbank rate	Interbank rate, M3 as intermediate target
Philippines	Yes, 2002	Inflation targeting: 4 ± 1% year-on-year CPI change for 2013-2014 and 3 ± 1% for 2015-2016	O/N repo & reverse repo rates	O/N repo & reverse RP rates	M0 as operating target and M3 as intermediate target
Singapore	No	S\$ NEER target range: modest and gradual appreciation path of the S\$NEER policy band for late 2013 to early 2014	Policy band for S\$ NEER	S\$ dollar NEER	FX against basket of currencies
Thailand	Yes, 2000	Inflation targeting: 0.5 - 3.0% for the year-on-year core CPI inflation in 2014	1-day bilateral RP rate	1-day bilateral RP rate	Money market liquidity, interbank lending rate, FX

¹ See Turner et al (1998) for more detail. ² In early 2014, the RBI's Patel Committee, an expert committee established by the Governor to revise and strengthen the Indian monetary policy framework, recommended adopt a flexible inflation targeting regime using a CPI target as the nominal anchor. After a suitable transition from its relatively high current inflation rates, the committee recommended that the target would be 4±2% and the operating target would be a term RP.

Source: national central banks.

Central bank total assets

Annex Table A2

	In billions of USD		Percentage of quantity indicated							
			GDP		Currency in circulation		M2		Domestic credit ¹	
	2002	2013 ²	2002	2013 ²	2002	2013 ²	2002	2013 ²	2002	2013 ²
China	617	5,223	42	55	296	542	28	29	35	30
Hong Kong SAR	122	391	74	140	845	966	27	30	48	54
India	96	413	18	23	177	211	28	28	52	38
Indonesia	73	131	36	17	665	316	74	42	137	42
Korea	149	434	25	34	746	776	21	24	16	19
Malaysia	43	146	42	48	598	669	42	33	30	37
Philippines	23	96	29	36	453	615	66	62	84	107
Singapore	85	279	92	97	1,202	1,219	82	71	82	69
Thailand	56	190	44	51	430	432	36	38	39	41
<i>Memo:</i>										
<i>Euro area</i>	849	3,132	11	24	212	233	17	25	8	15
<i>United Kingdom</i>	96	658	6	25	227	762	9	28	3	14
<i>United States</i>	732	4,033	7	24	112	337	13	36	5	14

¹ Domestic credit to private non-financial sector; bank credit for the Philippines; total credit otherwise. ² As of November or December 2013 depends on availability of data.

Sources: IMF *International Financial Statistics*; IMF *World Economic Outlook*; CEIC; Datastream; national data.