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November 13, 2013

ASSESSING RESERVE ADEQUACY – FURTHER CONSIDERATIONS

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- The **Staff Report** on Assessing Reserve Adequacy – Further Considerations, prepared by IMF staff and completed on November 13, 2013 for the Executive Board's consideration on December 4, 2013.
- **Staff Supplement** on Assessing Reserve Adequacy – Further Considerations.
- A **Press Release** summarizing the views of the Executive Board as expressed during its December 4, 2013 consideration of the staff report.

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ASSESSING RESERVE ADEQUACY—FURTHER CONSIDERATIONS

November 13, 2013

EXECUTIVE SUMMARY

Reserves remain a critical liquidity buffer for most countries. They are generally associated with lower crisis risks *(crisis prevention)* as well as space for authorities to respond to shocks (*crisis mitigation)*. While other instruments, such as official credit lines and bilateral swap lines, are also external buffers, for most countries they principally act as a complement to their official reserves. For countries with sound fundamentals and a good policy framework, reserves provide policy makers with considerable space to respond to transitory shocks. However, this space diminishes as fundamentals deteriorate and the existence of adequate reserves does not, by itself, eliminate the risk of market pressures.

This paper reviews and builds on the guidance developed in the 2011 *Assessing Reserve Adequacy* (ARA) policy paper. It has two aims: (i) to explore the role reserves play in preventing and mitigating crises; and (ii) to consider in what ways current guidance on adequacy may need to be augmented, in particular to account for country-specific factors. In doing this, the paper responds to outstanding issues identified by the IMF Board following the 2012 IEO evaluation *International Reserves—IMF Concerns and Country Perspectives*, and will be followed by a guidance note distilling the operational implications of the work contained in this paper.

The paper seeks to approach the question of reserve needs of a country by the maturity, depth and underlying liquidity of its markets as well as its economic flexibility, rather than by standard classifications (AM, EM, and LIC). Along these lines it finds that (i) despite having more liquid markets and a higher tolerance for foreign exchange volatility, many *mature market economies* may need to hold precautionary reserves to stem instances of severe market dysfunction and ease short-term foreign currency funding pressures; (ii) for *emerging and less-mature market economies*, the general guidance provided in ARA metric seems to have worked relatively well, although important refinements are suggested to better capture the risks faced by some specific types of economies; and (iii) for *LICs* with limited market access, there is a need for more specific guidance on the marginal cost of reserves.

Despite the significant benefits they provide, reserves can be costly. For countries with market access the paper supplements the net financial cost approach developed in ARA with evidence on the opportunity cost associated with sterilization. This measure is applicable to countries with relatively little foreign currency debt, and suggests that large sterilization needs can impose a significant quasi-fiscal cost. For LICs the paper provides more granular guidance on establishing a benchmark for the cost of reserves. For instance, frontier markets with minimal credit constraints face a different opportunity cost of reserves compared with resource-rich LICs, which face the choice between investing windfalls at home or abroad, and a LIC with net capital inflows, where sterilization costs matter the most.

Approved By
Siddharth Tiwari

Prepared by a staff team led by Nathan Porter comprising Sibabrata Das, Phil de Imus, Ghada Fayad, Monica Gao, Shuntaro Hara, Carla Intal, Armine Khachatryan, Kenji Moriyama, Nkunde Mwase, Roberto Perrelli, Preya Sharma and Ruud Vermeulen, under the general guidance of David Marston, Sean Nolan, Thanos Arvanitis, Catherine Pattillo, and James Roaf. The work on low income economies was coordinated by Nkunde Mwase.

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INTRODUCTION

1. The global financial crisis reaffirmed the importance of holding adequate reserves. As discussed in the 2011 policy paper *Assessing Reserve Adequacy* (ARA), emerging market countries (EMs) with adequate reserve holdings ahead of the crisis generally suffered smaller output and consumption declines. Although the crisis led to greater exchange rate movement, a number of emerging and advanced economies used reserves during periods of exchange market pressure and dysfunction in foreign exchange and funding markets.

2. The ARA sought to strengthen guidance on reserve adequacy across different types of economies. In this regard, it reviewed approaches to reserve adequacy for precautionary motives, and presented new analytical work particularly focused on EMs and low income countries (LICs), with a more general discussion of considerations for advanced market countries (AMs). While the work was not intended to provide a definitive ruling on reserve adequacy, it provided adequacy metrics, and broader guidance on appropriate ranges of reserve holdings as a starting point beyond which a detailed examination of country specific risk factors and resources to address them would be useful.

3. This paper builds on the guidance developed in the 2011 ARA paper, and is also exclusively focused on reserves held for *precautionary* motives. It has two aims: First, to further explore the use of reserves in recent years and their role—in conjunction with other external liquidity buffers—in preventing and mitigating crises. While it discusses issues regarding the effectiveness and modalities of intervention, it takes the choice of a country's exchange rate regime as given. Second, to review the current guidance on adequacy metrics, and consider in what ways it may need to be augmented to better account for country-specific factors in a consistent way across countries. In this respect, the paper seeks to address outstanding issues identified by the Board following the IEO's 2012 evaluation *International Reserves—IMF Concerns and Country Perspectives*.[1] A specific guidance note on reserve adequacy will be prepared at a later stage distilling the operational implications of the work contained in this paper.

4. The paper underscores that reserve needs ultimately reflect the maturity, depth and the underlying liquidity of a country's market as well as its economic flexibility. These characteristics do not always align with the standard classification of advanced, emerging, and low income countries as economies have become increasingly complex. At the same time, patterns of reserve accumulation have become more mixed since the Lehman crisis, with the pace of reserve accumulation in EMs slowing, partly reflecting the active use of reserves in some regions, and that of

[1] In March 2013 the IMF's Board endorsed Management's plan to follow-up on this evaluation. The plan included the preparation of a successor policy paper as well as a guidance note on operational issues.

AMs generally picking-up.[2] Within each type of economy reserve needs also depend on the nature of the exchange rate regime and, as developed further below, are generally higher for countries with fixed exchange rates. LIC reserves accumulation has moved more closely with traditional metrics, like three-months of import coverage, although it generally continues to lag behind desirable prudential levels.

5. The findings reaffirm that, by and large, reserves remain critical external buffers for most countries. The paper reaffirms the 2011 findings that reserves are associated with lower crisis risk (*crisis prevention*) and provide space for authorities to respond to foreign liquidity shocks (*crisis mitigation*). However, their ability to play these roles depends on the underlying strength of the country's fundamentals and policy settings. As evidenced by events between May and August of 2013 in EMs, weak policies and fundamentals would seem to raise the risks a country faces despite its reserve holdings, and reduce the impact of intervention.

6. Prudent ranges of reserve buffers depend on the underlying characteristics of each economy. The paper argues that reserve needs for those with mature and robustly liquid markets should be centered on the need to stem instances of market dysfunction. These have often been closely, but not exclusively, associated with short-term foreign currency bank funding needs. For less-mature markets, the paper finds that the guidance provided for emerging markets in ARA seems to have worked relatively well, although this could be further refined along some important dimensions, including for commodity intensive and dollarized economies. The metric could also have a higher weight on the risks associated with longer-term debt and portfolio equity liabilities. For LICs with limited access to markets, the paper seeks to provide more operational guidance on the cost of reserves for such economies, further operationalizing the framework developed in ARA. These conclusions benefited from responses to a survey of reserve managers, which provided essential granularity and context for the analysis undertaken by staff.

7. Actual reserve holdings are challenging to model. No single explanation can account for the behavior of all countries at all times—for instance, before 1997 reserves demand seemed to be driven mainly by the need for insurance against current account shocks, while after the Asian crisis, insurance against capital account shocks gained importance. Such analysis complements the assessment of adequacy, and is informative about the motives that might drive the decisions on actual reserve holdings. It also allows one to judge whether a country's reserve holdings differ from those of other countries with similar characteristics. While such peer comparisons provide useful information, assessing adequacy solely through peer comparison should be avoided as these comparisons delink reserve adequacy from fundamental vulnerabilities.

8. Large reserve holdings should take into consideration their relatively high cost. Despite their benefits, the paper finds that opportunity costs associated with reserves become increasingly

[2] This reserves build up is beyond what can be explained by valuation changes. In fact, only a small share (less than 1 percent) of the estimated change in EM reserves has been accounted for by valuation changes.

expensive as reserves reach high levels. As mentioned above, the cost-benefit of holding reserves is assessed purely through, and the focus of this paper is on, the precautionary motive for reserves. While countries with exceptionally high levels of reserves may pose externalities on others, as noted in IMF (2013), such external costs are best dealt with in the Fund's multilateral surveillance products, such as the ESR or Spillovers report.

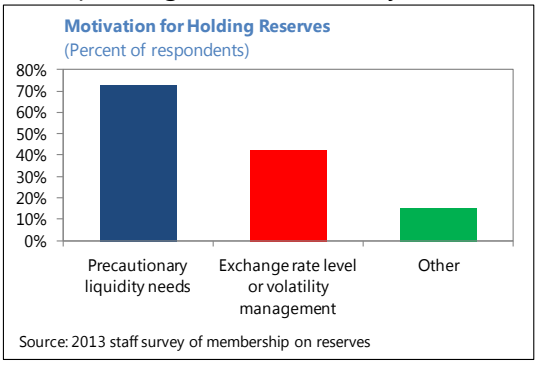
9. Reflecting its twin aims, the paper is organized into two parts. Part I considers the role of reserves as an external buffer. Specifically, section I.I describes the role reserves play relative to other external buffers (such as central bank swap lines), while section I.II describes when and how intervention may be successful in addressing external pressure. Part II looks at the considerations for assessing reserve adequacy in mature (section II.I) and less-mature (section II.II) economies with market access. Section II.III describes the considerations underpinning the opportunity cost of reserves for these economies, while section II.IV discusses reserve issues for LICs with limited access to financial markets, and section II.V describes the special characteristics of currency unions and dollarized economies.

PART I: RESERVES AND BUFFERS: THEIR ROLE AND USE

I. What Role Do Reserves Play?

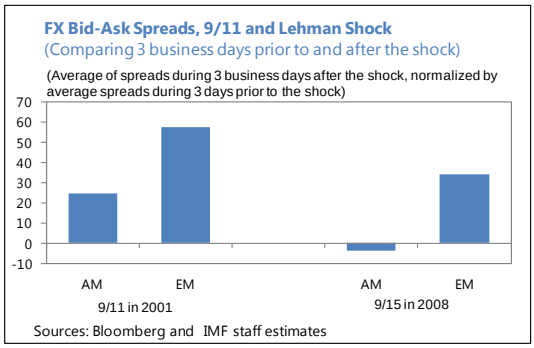
A. The Role of External Buffers

10. Reserves are an essential external liquidity buffer—a survey of country authorities suggest that around three-quarters saw this as the critical reason for building reserves, with around 40 percent holding reserves to manage either exchange rate volatility or levels. However, the need for such buffers has long been seen to differ across countries, depending on their flexibility and resilience in the face of shocks, and the size and frequency of shocks. In particular, other things equal, economies with less established access to international financial markets, or large external imbalances, are likely to have a larger need for external buffers in order to absorb the impact of exogenous external financing shocks. However, this need could be mitigated by a resilient and buffered financial sector, as well as good policies and a flexible economic structure, or by other factors such as the presence of effective capital flow measures.



11. Experience since the start of the global financial crisis, where reserves were used by some AMs, suggests that reserves form an important buffer for advanced economies. Traditionally AMs have not been seen as needing high levels of external buffers, reflecting the strength of their institutions, their better established access to international financial markets and

flexible exchange rates. However, several AMs with flexible exchange rates used reserves (e.g., Australia and Sweden) in the immediate aftermath of the Lehman failure. This does not suggest they need the same reserves as less mature emerging markets given that factors which bolster the tolerance to exchange rate flexibility—market depth and liquidity, and economic flexibility—remain important differences between advanced and emerging market economies (Figure 1). Provided FX markets remain deep and liquid, there is less need for large buffers to stabilize exchange rates against shocks, but buffers remain critical if there is a risk that liquidity can evaporate during systemic events. Experience since the early 2000s suggests that advanced countries are typically more resilient, and are less likely to suffer periods of market dysfunction, with these economies maintaining lower and less volatile spreads even during periods of heightened stress. Indeed, as a defining characteristic of their market maturity, liquidity (as measured by their exchange rate bid-ask spreads) has been much more resilient during times of systemic stress (e.g., in September 2001 and September 2008). In addition, AMs seem to react more flexibly through their ability to respond to external events (proxied by exchange rate changes). Specifically, output in AMs is less responsive to exchange rate shocks suggesting the ability for greater use of exchange rate flexibility to absorb external shocks.



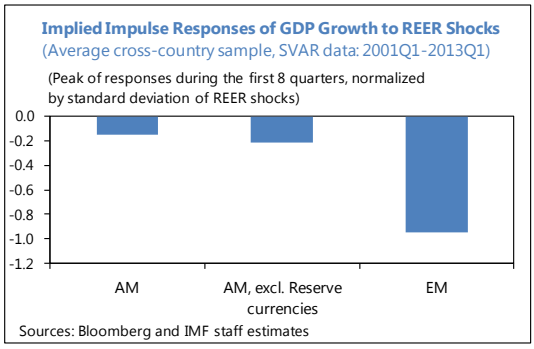
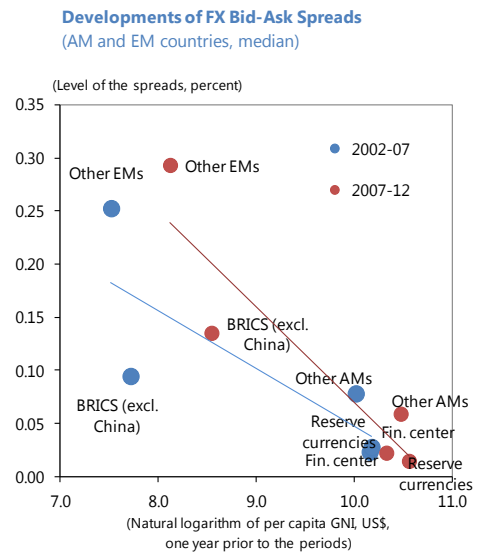
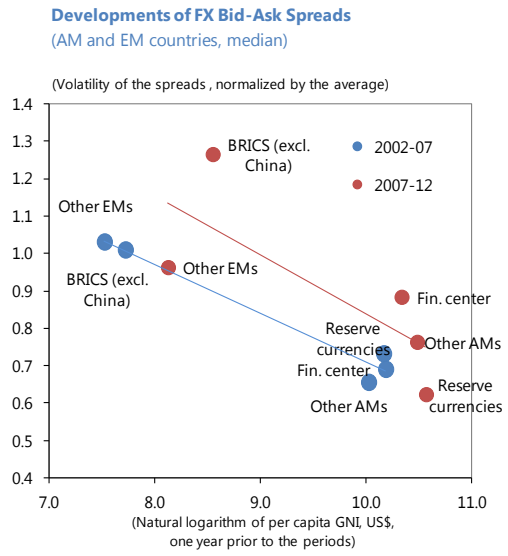


Figure 1. Exchange Market Liquidity in Selected Markets

a. Level of spreads



b. Volatility of spreads

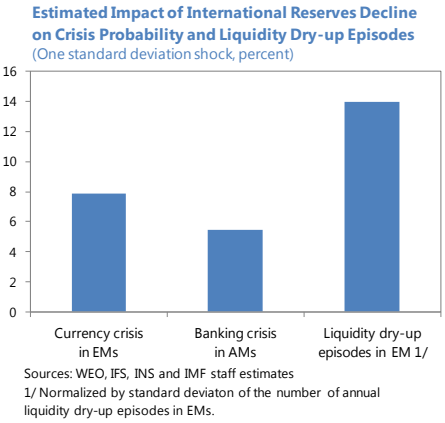


Source: WDI and IMF staff estimates

12. Reserve buffers seem to play different roles in advanced and emerging economies.[3] In EMs reserves significantly reduce the risks of a currency crisis, as well as the number of episodes of shortage of foreign exchange market liquidity (Figure 2.a), although these benefits decline at high levels of reserves. As such, reserve buffers are associated with a lower assessment of country risk, and lower interest rates. As discussed in ARA and later in this paper, the marginal benefits to reserves decline at high levels as the marginal reduction in the likelihood of exchange market pressure and marginal reduction in yields decline. As discussed in the next part of the paper, the marginal cost of reserves also rises with higher reserve holdings. The empirical evidence is less clear for AMs, possibly reflecting the difficulty in identifying the effect given the limited number of currency crises in advanced economies. However, reserve buffers are associated with a lower risk of banking crises in AMs, possibly reflecting the ability higher reserves provide to a central bank to extend foreign exchange liquidity to banks.

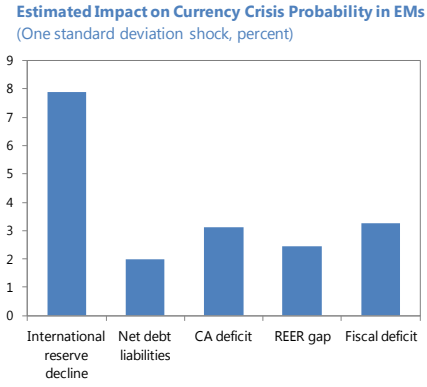
Figure 2. Reserves, Vulnerabilities, and Policies and Crisis Probabilities (In percentage points)

a. Reserves



Sources: WEO, IFS, INS and IMF staff estimates
1/ Normalized by standard deviaton of the number of annual liquidity dry-up episodes in EMs.

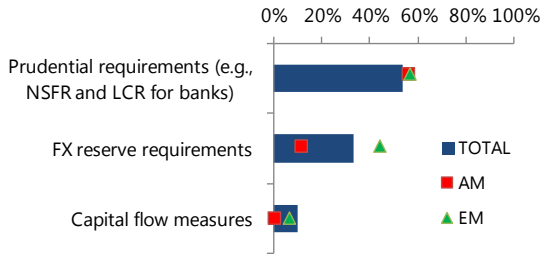
b. Vulnerabilities and Policy



Sources: WEO, IFS, INS and IMF staff estimates

13. Despite the significant impact of reserves on the crisis probability, they cannot fully eliminate the risk that a country may come under pressure. Events in May 2013 brought the issue into stark focus with some countries holding high levels of reserves coming under market pressure. The impact of reserves on lowering crisis risk is only a partial effect, with other—fundamental and policy—factors also

What Policy Instruments are Used to Limit the Risks from Banks' Foreign Exchange Liquidity Needs?



Source: 2013 staff survey of membership on reserves

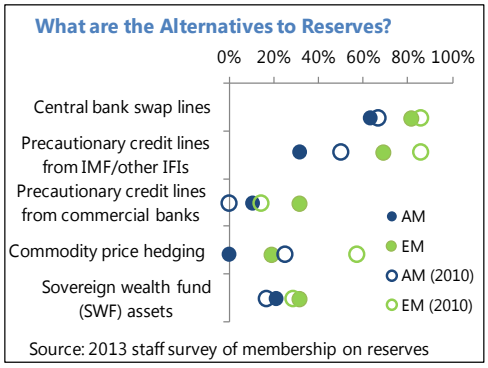
[3] See Chapter 1 of the Assessing Reserve Adequacy – Further Considerations – Supplementary Information for additional details.

playing a critical role. Consequently, while reserves, which are primarily a liquidity buffer, can ameliorate the impact of other weaknesses, they may not offset high vulnerabilities or policy choices which diminish policy space and further add to vulnerabilities. In particular, Figure 2.b shows that for emerging markets high external leverage, overvaluation, and large fiscal gaps all significantly raise the risk of a currency crisis. Relatedly, around half of respondent AM and EM central banks said that prudential requirements played a role in limiting the risks from banks' foreign exchange liquidity needs, more than those who said reserve buffers played this role.

14. While there may be a renewed sense of reserve needs across different types of economies, it remains essential to recognize that these needs do depend on the economic structure. In particular, with needs reflecting the depth and liquidity of markets this paper broadly segments the discussion by the type of the economy, based on market maturity and flexibility. To this end, the paper hopes to move away from reserve needs based on the more rigid traditional classification of AMs, EMs, and LICs. While there may be considerable overlap between traditional labels and market maturity it is not complete—some low-income countries have access to international markets, while market maturity varies across AMs.

B. Reserves and Near-Reserves

15. Reserves are not the only form of external buffers. Alternative forms include (public and private) credit lines, central bank swap lines, and commodity hedges. Surveys of country authorities (in 2011 and for this paper) found that almost all respondents thought that swap lines and contingent credit lines provided by IFIs had reserve-like features, but private credit lines and commodity hedges were not so close.



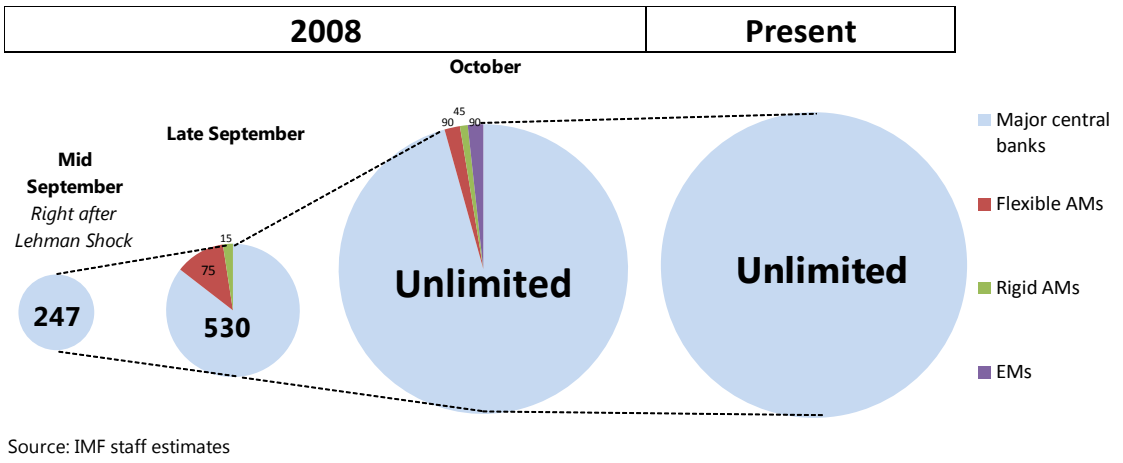
16. While central bank swap lines and contingent IFI facilities have reserve-like features, they differ from reserves in important ways. In particular while both can perform the role of reserves when activated, they do not constitute an asset for the authorities, and their availability in times of stress is not certain.

- *USD swap lines.*[4] During the global financial crisis, temporary USD swap lines were put in place promptly by the US Federal Reserve and provided an important external liquidity backstop for a number of emerging and advanced economies (Chapter 4 of the supplement). However, while these lines have remained a relatively constant part of the tool kit for some major central banks—ECB, SNB, BOJ, BOE, and BOC—for other central banks in mature and emerging market

[4] In addition to swap lines among central banks described here, there are regional financial arrangements in a number of regions for the purpose of providing sufficient and timely financial support to ensure financial stability. One example is the The Chiang Mai Initiative Multilateralization, although this has not yet been activated (see IMF 2013a).

economies the lines were both smaller and ultimately temporary (see Figure 3). This suggests that while some core central banks may find swap lines a close substitute for reserves, this is not the case for others who, particularly during time of idiosyncratic stress, may not be able to rely on these facilities.

Figure 3. Allocation and Access in U.S. Dollar Swap Lines
(USD billion)



Source: IMF staff estimates

- *Non-USD swap lines*. In addition to USD swap lines, non-USD swap lines were also put in place among central banks. These additional lines provide the core central banks with another form of reserves.[5]

- *IFI credit lines*. Credit lines like the FCL and PLL are an important complement to reserves during times of heightened stress. They play much same role as CB lines and bring the advantage that they include a "stamp of approval" over a member's policies. As a reserve complement, they are designed to provide access to insurance which can be put in place at times of heightened risk and, if necessary, tapped during times of stress. However, as with other credit lines these lines do not have the same permanence as reserves, lasting for at most two years at a time, and are subject to periodic reviews, which limits the certainty of availability to the monetary authorities at some points.

[5] China has also been setting up renminbi (RMB) bilateral swap lines with both mature and less mature market countries, especially in recent years. The swap lines total more than RMB 2 trillion (approximately $330 billion), and should serve their purpose of "strengthening bilateral financial cooperation and promote trade and investment" as well as "safeguarding regional financial stability." However, the RMB does not yet constitute a core currency, hence reserves at present. Nonetheless, these lines would help a country manage a shock through an ability to cover imports denominated in renminbi.

17. Coordinated and pre-committed swap lines would provide a useful alternative precautionary buffer to self-insurance if sufficiently predictable. In principal, these lines can be created at little direct cost by reserve issuing central banks, potentially making them an effective precautionary buffer for countries. However, there are a number of issues—from the perspective of both the issuer and recipient of the swap line—which would make greater use of swap lines difficult.

- *Issuer*: Issuing swap lines to a very broad set of countries could be seen as inconsistent with the domestically focused mandate of central banks, typically comprising price and financial stability. In addition, the originating central banks would face credit risk, which may be difficult to price. As a result, they may be hesitant to take such risk particularly if the issued lines are ultimately used in the defense of a misaligned currency without the necessary adjustment that may jeopardize repayment.

- *Recipient*: The predictability of any swap line is a primary concern for recipient countries. As discussed above, many of the swap lines created during the immediate post-Lehman period did not remain a permanent part of the toolkit. Moreover, in the case of the Fed swap lines there was an expectation for the country to use their own reserves before resorting to the swap line. Also in cases where activation of the swaps is linked to triggers there might be uncertainty caused by interpretation differences about whether a specific event has triggered their activation.

II. Intervention: Effectiveness and Modalities

18. As discussed in the previous section, **reserves are important in *preventing* (or at least limiting the risk of) crises**. While reserves are associated with a lower probability of currency or banking crises, a critical question remains—is intervention effective in the face of depreciation pressures? Indeed, respondents to our survey reported that reserves are primarily held as a precautionary liquidity buffer or to smooth excessive exchange rate volatility, however about 40 percent of EM respondents also said that they hold reserves to manage the level of the exchange rate, suggesting that in a sense it is effective. After summarizing recent patterns of intervention this section describes when intervention is likely to be effective.

A. The Effectiveness of Intervention

19. The effectiveness of intervention has been a long standing question (see Sarno and Taylor, 2001 and 2002). Unsterilized intervention is generally seen as effective, but the effectiveness of sterilized intervention has been less clear. Intervention is thought to work through two main channels: (i) a portfolio balance channel due to changes in the composition of domestic and foreign assets held by residents; and (ii) a signaling channel which works if exchange rate interventions (reflecting intervention policy) signal the future stance of monetary policy and hence "official intervention does not represent an instrument independent of monetary policy" (Sarno and Taylor, 2001, p. 845).

20. The theoretical literature on currency crises casts doubts on the usefulness of intervention (See Chapter 2 of the supplement). In particular currency crisis models highlight the ineffectiveness of intervention when the exchange rate is inconsistent with other macroeconomic policies, with intervention even possibly increasing the risk of a speculative attack when fiscal, monetary, and exchange rate policies are set inconsistently (or could even potentially be set inconsistently). In such cases, ensuring credible and consistent policy and sound fundamentals is the principal mechanism to limit the risk of external pressure. While policies are adjusted, intervention can play a role in limiting the risk of a crisis or mitigate the effects of pressure by providing a buffer to smooth temporary shocks and deal with transitory market dysfunction, including foreign currency liquidity to financial intermediaries if necessary.

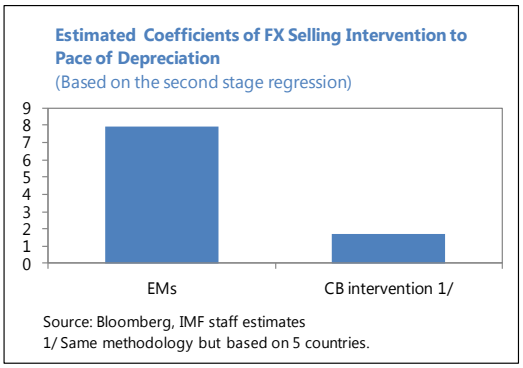
21. The empirical evidence on the effectiveness of sterilized intervention is somewhat more positive, with some support for intervention at least affecting the rate of change in the exchange rate. Sarno and Taylor (2001) report that for advanced economies intervention seems particularly effective during "periods of high reputation and heavy sterilized intervention," (p. 854), and "if it is publicly announced and concerted" (p. 855). Dominguez (2003) uses high frequency intra-day data in G3 economies—the USA, Japan, and Germany— and finds that (i) FX interventions influence FX returns and volatility and (ii) the efficacy of intervention depends on the characteristics of FX market. Similarly, Kearnes and Rigobon (2005) find, for Australia, using a change in intervention policy for identification, a significant contemporaneous impact on the level of the currency. Adler and Tovar (2011) find that for EMs during these episodes of appreciation pressure intervention can significantly affect the pace of appreciation but not the level of the exchange rate. Kohlscheen and Andrade (2013) use high-frequency data of FX and official currency swap auctions in Brazil and demonstrate that public auctions have an economically and statistically significant effect on FX rate. In a more general survey of the effectiveness of intervention in EMs, Ostry and others (2012, p. 12) find that "the evidence on the effectiveness of sterilized intervention in EMEs is mixed, but generally more favorable than in the advanced economy context. The very fact that many, if not most, EME central banks undertake sterilized intervention suggests that at least they believe it to be effective in their own currency markets."

22. We extend this empirical literature by looking into a broad set of countries and focusing on depreciation episodes. Specifically, we estimate both intervention policy reaction functions and the impact of intervention on the exchange rate, allowing differential responses depending on the direction of intervention.[6] The sample covers 49 emerging markets, but we also separately estimate the relationship using actual intervention data from Chile, Colombia, Mexico, Peru and Turkey. In a two-stage estimation procedure (to account for endogeneity), decisions on intervention policy are assumed to depend on recent exchange rate moves and volatility, the level of reserves held by the central bank, the extent of exchange rate misalignment, and the level of

[6] See Assessing Reserve Adequacy – Further Considerations – Supplementary Information for the specific details of this work.

international reserves. Separately, each EM's exchange rate (and its movements) is modeled as a function of short-term interest rates and longer-term sovereign spreads, commodity prices fluctuations, market volatility (VIX), as well as central bank intervention.

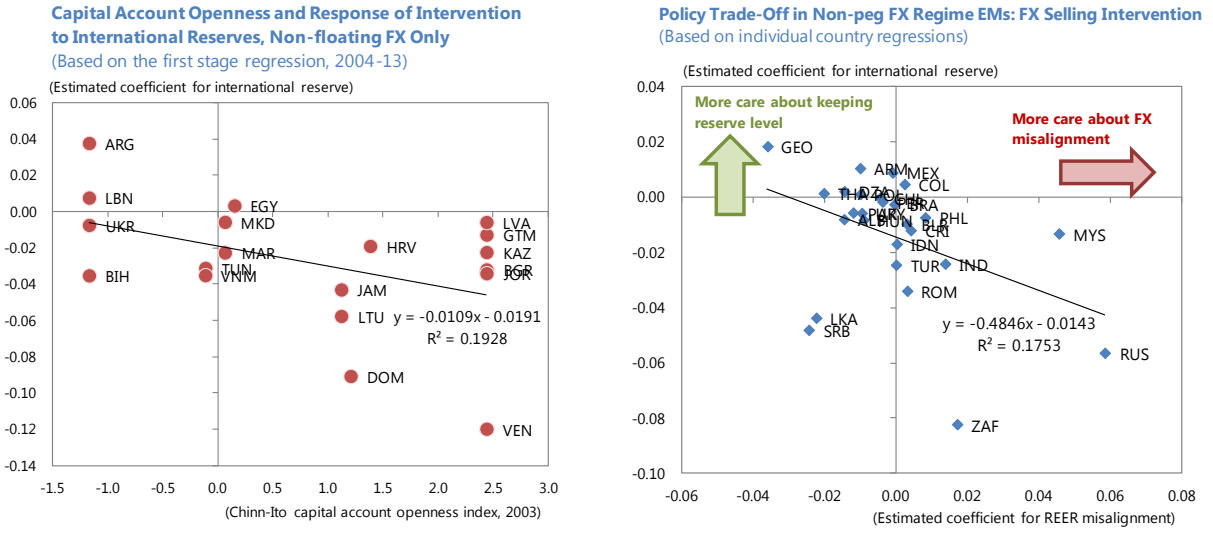
23. We find that central banks' intervention policy reaction functions vary considerably, depending on some key structural characteristics. The results suggest that: (i) countries with less flexible exchange rate regimes tend to intervene more aggressively (as a function of their reserves) on both sides, but especially when they are defending against depreciation pressure—the coefficient on the stock of reserves is twice that when purchasing foreign exchange);[7] (ii) countries with less open capital accounts (as measured by the Chinn-Ito Index) tend to intervene less reflecting the lower near-term outflow risks even when they have rigid currencies (Figure 4, left); and (iii) while selling intervention does not prevent depreciation, it can slow the rate of depreciation over a relatively short period. This result is consistent with the result of Adler and Tovar (2011) during periods of appreciation pressure. Indeed, these estimates would suggest that for the median intervention seen post-Lehman (0.6 percent of GDP), the pace of depreciation would have been temporarily slowed by about 5 percentage points. The impact of intervention also seems stronger for those countries with capital controls.[8] Finally, central banks with relatively flexible currencies also seem to trade-off a desire to maintain or supplement reserves or address misalignment, which comes out of the estimated policy rules (Figure 4, right).



[7] There is no relationship for countries with flexible exchange rates.

[8] Estimating the same relationship separately for countries with significant capital controls (bottom quartile of the Chinn-Ito index) and the least capital controls (top quartile of the Chinn-Ito index) reveals a significant difference in the impact the pace of depreciation at the 5 percent level of significance.

Figure 4. Implications from the Estimated Policy Rules



Source: IFS, Chinn and Ito (2008), WEO, IMF staff estimates

B. Recent Intervention and Modalities

24. Emerging markets have tended to intervene in an asymmetric manner. While some emerging markets maintain considerable exchange rate flexibility, only intervening during periods of heightened market volatility, others have intervened more frequently (Table 1).[9] A decomposition of the exchange market pressure (EMP) index (Figure 5) across EMs shows that the exchange rate seems to be the primary defense in all but the most severe events.

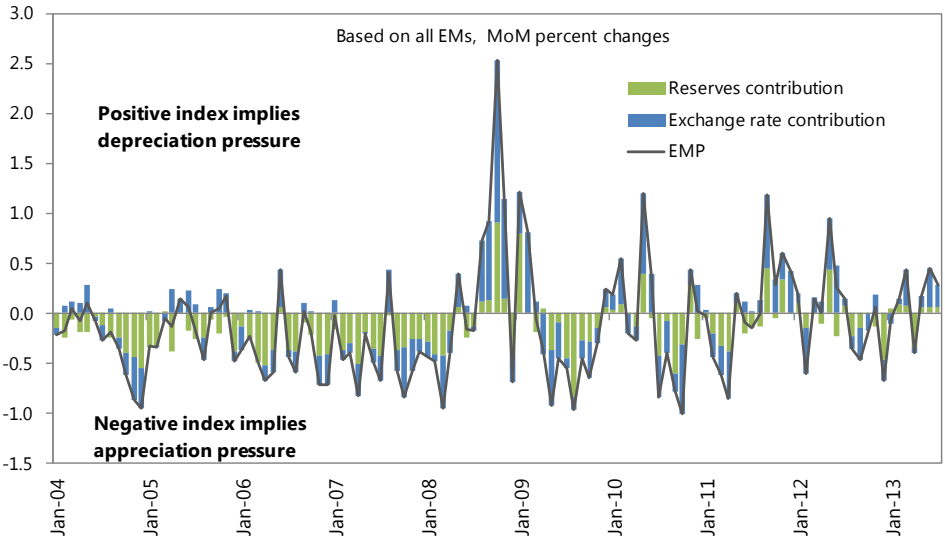
Table 1. Reserves Movements During Currency Appreciation / Depreciation[1]

Share of appreciation / depreciation episodes		Appreciates	Depreciates
Reserves	Rise	76%	49%
	Fall	24%	51%

1/ Monthly data from 2004-13 for EMs.

[9] The same pattern emerges when the balance of payments estimate of the change in reserves (which excludes valuation changes) is used.

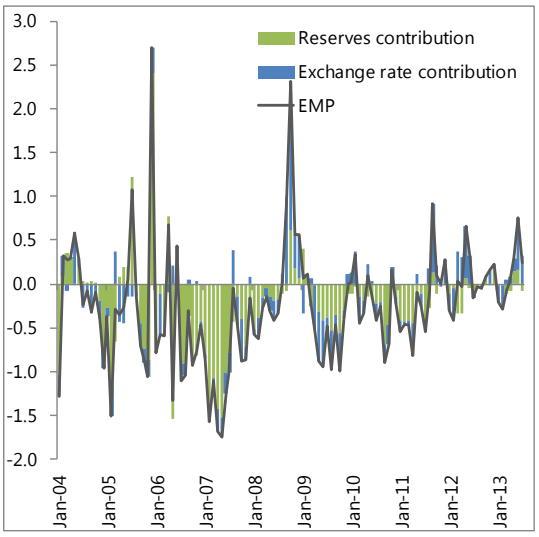
Figure 5a. Decomposition of Exchange Market Pressure (EM Average)



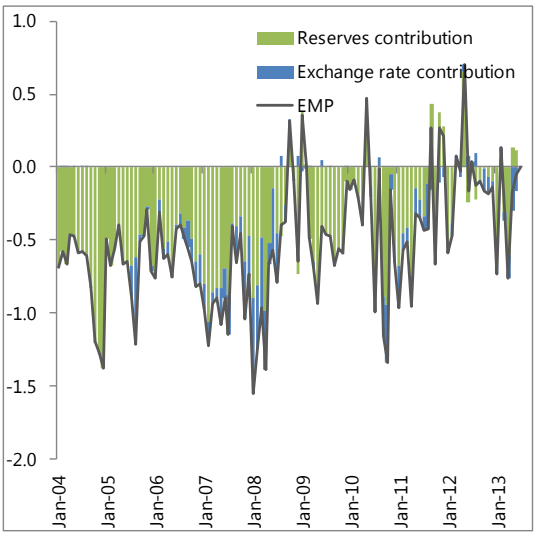
Source: IFS and IMF staff estimates

Figure 5b. Decomposition of Exchange Market Pressure

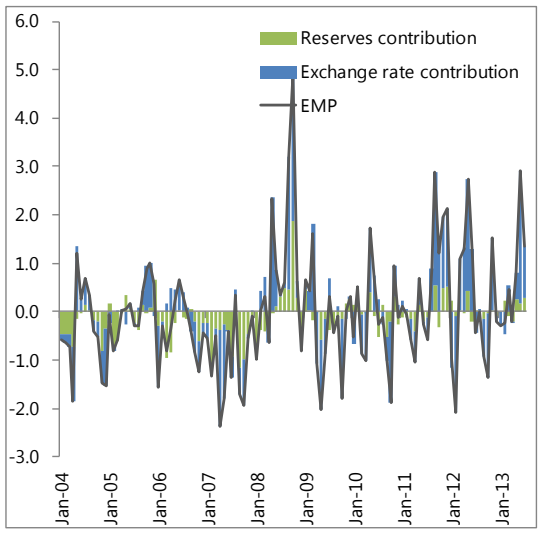
Brazil



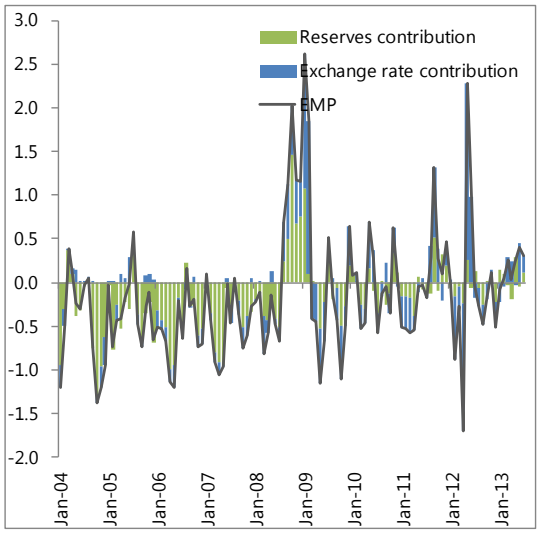
China



India

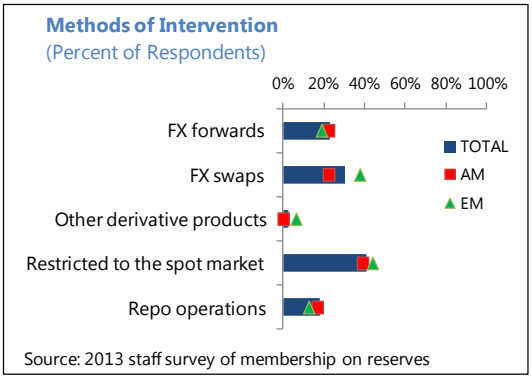


Russia



Source: IFS and IMF staff estimates

25. Intervention can take different forms. Spot market foreign exchange purchases or sales remain a major form of intervention although some central banks also intervene in derivatives markets.[10] Indeed, in the survey conducted for this paper about half of the respondents reported restricting intervention to only the spot market. However, intervention in the derivatives markets has also been used. Exchange rate options, for instance, offer the possibility of implementing rules based intervention depending on the strike price chosen. Swap and forward transactions—reportedly only used by around one-third of EM respondents—have also played an increasing role in reserve management, sterilization, and allowing private counterparties a mechanism through which to hedge exposure without having to actually withdraw from a market. Countries holding long positions have foreign currency resources which augment their forward looking liquidity position. By engaging in forward and swap arrangements, central banks are able to manage domestic liquidity and intervene in the spot market without impacting headline official reserve figures. During the crisis, a number of countries which had consistently been holding net long positions ran these down,

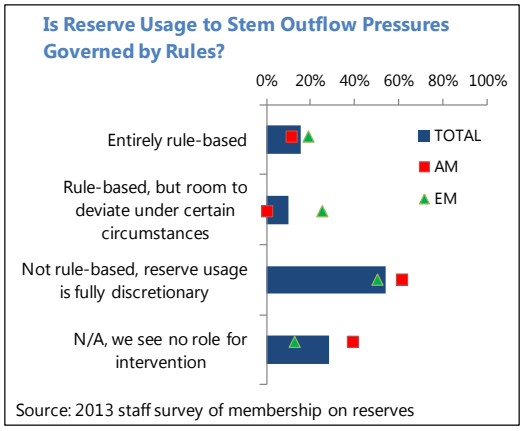


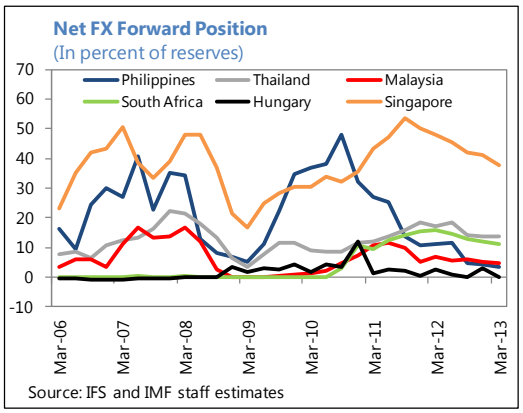
Source: 2013 staff survey of membership on reserves

[10] For example, according to Basu and Varoudakis (2013), the Reserve Bank of South Africa and the Reserve Bank of India have on occasions resorted to forward market FX intervention. FX options have also been used by Mexico, Colombia, Chile, and Brazil.

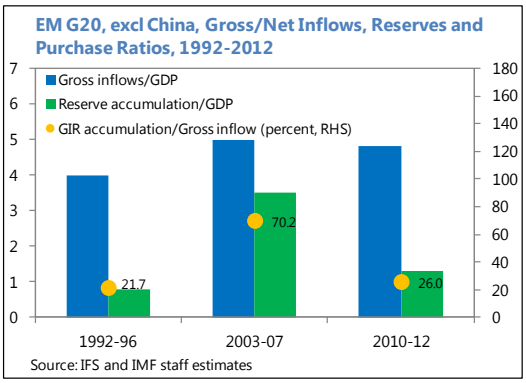
but this was done by increasing their short position, enabling their central banks to intervene while limiting the impact on headline reserves. Few countries report net short positions.

26. The choice of intervention strategy depends on the source of exchange market pressure and a range of additional considerations. In response to the survey, almost half of EMs (51 percent) reported that their reserve usage (in the face of outflow pressures) is fully discretionary and not rules based, although a similar number report some form of rules based intervention (with varying degrees of discretion). The significant number of authorities reporting the absence of a rule regarding intervention may, to some extent, reflect the idiosyncratic nature of episodes of stress, requiring alternative forms of intervention strategy and approach. For example, prospects of an early tapering of the US Federal Reserve's (FED) asset purchase program prompted large nominal depreciations in emerging markets' currencies starting May 2013. Among the currencies that weakened most was the Brazilian real (BRL). In response the central bank announced a large intervention program with a cumulative amount equivalent to US$55billion, consisting of daily auctions of foreign-exchange swaps (to allow private agents to hedge their real exposure) amounting up to US$0.5 billion per day from Monday thru Thursday of each week until year-end, along with auctions up to US$1 billion in repos (to provide short-term foreign exchange liquidity should there be near-term pressure to sell the real) on Fridays during the same period. This particular approach was adopted in response to the perceived nature of pressures, principally the demand for hedging operations rather than a desire to sell their exposure to Brazil.





27. Overall, the decision and scope for intervention in the foreign exchange market should be considered on a case-by-case basis. The scope of intervention is a live issue among policy makers. A number of countries managed the period of capital flows through intervention to accumulate reserves, and several EM countries met the recent episode of outflows through a combination of policy adjustment, use of reserves, and exchange rate flexibility. This paper supports the view, also outlined in the Fund's institutional view on capital flows (IMF, 2012), that intervention could be a useful instrument when pressures are expected to be temporary, economic fundamentals are sound, and if intervention



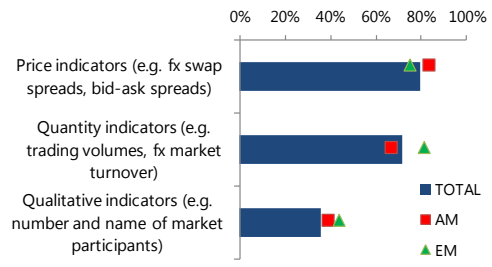
is coordinated carefully with other policies. For instance, among the key parameters in deciding the scope and size of intervention are the extent of currency misalignment, the state of the economy, and the adequacy of reserves. Intervention without clearly adequate reserves or a sense of the equilibrium parity could prove risky in circumstances where a country is trying to defend a misaligned currency. Other economic policies need to be supportive to ensure the success of intervention. Clearly, intervention is not appropriate in all cases, and a weaker currency may be a beneficial course of action when the economy is underperforming (negative output gap), or if sovereign and private balance sheets are less exposed to FX risk.

PART II. ASSESSING THE ADEQUACY AND COST OF RESERVES

I. Do Mature Markets and Flexible Economies Need Reserves?

28. Mature market economies may need to hold international reserves for precautionary purposes, despite having more liquid markets and a higher tolerance for foreign exchange volatility. While episodes of market dysfunction are relatively rare and of short duration, the global financial crisis served as a reminder that even these economies are not immune to foreign exchange and funding market stress (Box 1). Responses to our survey suggest that many central banks rely on price-based indicators, like swap rates, to signal conditions in the foreign exchange market that indicate market dysfunction.

What Indicators Signal Exchange Market Conditions and Market Dysfunction?



Source: 2013 staff survey of membership on reserves

29. During the global financial crisis, financial institutions were shut out from funding markets, including the foreign exchange (FX) swap market. The implied US dollar FX swap rate shot up to record high levels in a wide range of advanced economies and the spread against U.S. dollar Libor, which in normal times fluctuates around near zero, widened sharply to record highs as market transactions de facto froze (Box 2). Countries with financial institutions that rely heavily on dollar funding markets, such as Sweden and Australia, were affected, and the spread against US dollar Libor (risk premium) surged (Figure 6).[11] In most cases, market dysfunction measured in this way lasted for two to three weeks (Figure 7). While this event indicates that no market is immune to a global financial crisis, an idiosyncratic shock could also be a trigger of considerable market stress.

[11] These premia are estimated as the spread between the implied US dollar FX swap rate and the upper bound of the theoretical rate band derived under a non-arbitrage condition (see Ando, M. (2012)).

Box 1. Episodes of FX Swap Market Dysfunction

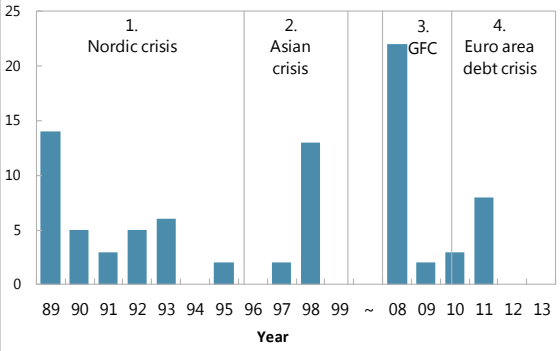
Dysfunction in FX swap markets occurs when liquidity suddenly tightens and transactions freeze. This can be seen in the difference between the cost of off-shore funding (e.g., in US dollars) through FX swaps and the costs of on-shore unsecured funding in the same currency. During normal market conditions arbitrage ensures that deviations from covered interest parity (CIP) remain small (see Chapter 4 of the supplement). Large deviations from CIP signal stress in the FX swap market (see also Baba and Packer (2009) and Barkbu and Ong (2010)).

In this paper we define FX market dysfunction episodes as extreme multi-day deviations from CIP, where the implied US dollar FX swap spreads exceed their 99th percentile value. From January 1989 to August 2013, we identify 85 such episodes.

These episodes can be divided into four dysfunction periods. *First*, the Nordic banking crises of the early 1990s. Out of the 35 episodes between January 1989 and March 1995, 29 took place in Norway (13), Sweden (10), or Denmark (6). These were clearly idiosyncratic shocks. *Second*, all episodes of market dysfunction observed between April 1995 and August 2007 took place during the Asia crisis, with dysfunction in the Hong Kong dollar–US dollar swap market accounting for more than 85 percent of dysfunction episodes. *Third*, the global financial crisis saw 23 episodes of market dysfunction. These were more synchronized across currencies, reflecting the systematic nature of the shock. *Finally*, another 12 episodes of market dysfunction were observed post-GFC, which were concentrated in the euro area, Singapore, and Switzerland.

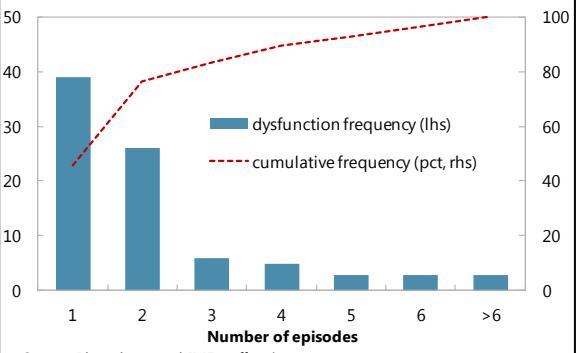
Historically, the bulk of dysfunction episodes lasted for no more than two weeks (about 80 percent, middle figure, in part reflecting successful efforts to stem market dysfunction. However, during the GFC, both frequency and duration of dysfunction episodes increased dramatically (bottom figure). With an average duration of more than three weeks, these events lasted significantly longer than pre-GFC dysfunction episodes.

Episodes of FX Market Dysfunction and Banking Crisis
Number of crisis across 13 advanced economies since 1989



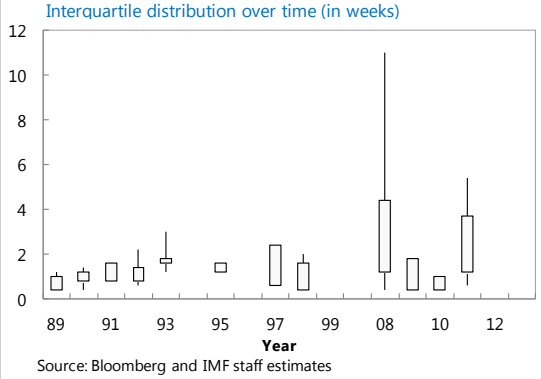
Source: Bloomberg, Laeven and Valencia (2012) and IMF staff estimates

Histogram of dysfunction episodes
Frequency of dysfunction episodes (y-axis) by duration in weeks (x-xis)



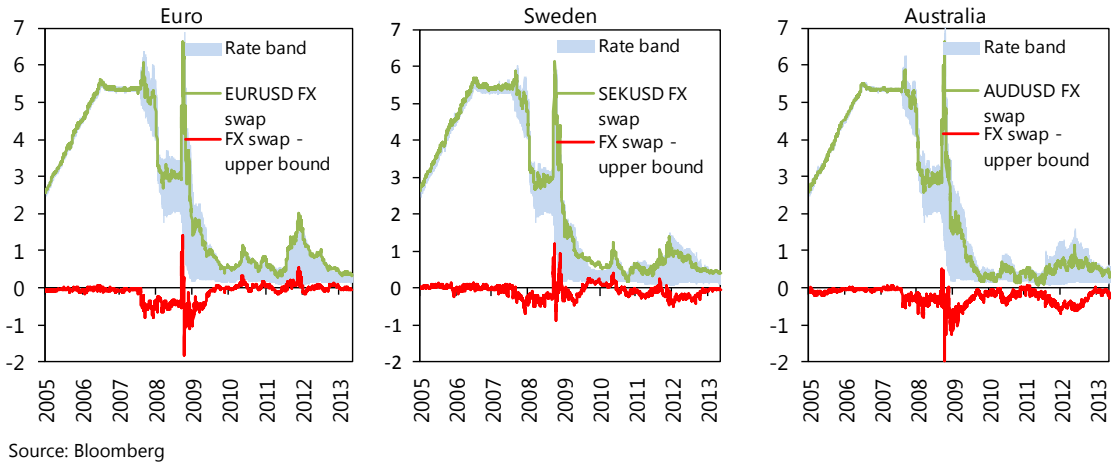
Source: Bloomberg and IMF staff estimates

Duration of dysfunction episodes
Interquartile distribution over time (in weeks)



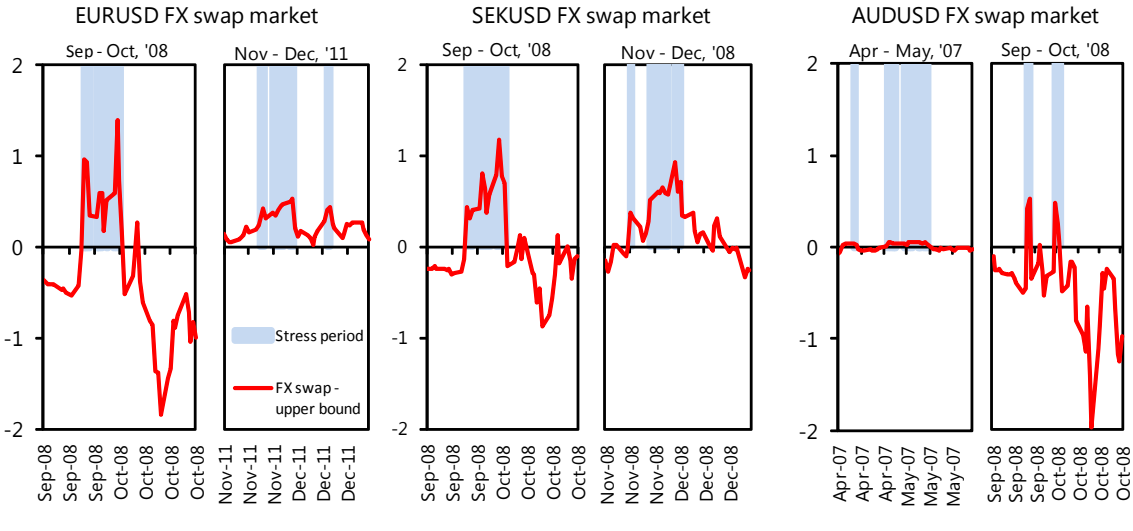
Source: Bloomberg and IMF staff estimates

Figure 6. Implied U.S. Dollar FX Swap Rate and Risk Premium in the Market
(In percentage points)



Source: Bloomberg

Figure 7. Periods of Market Dysfunction
(In percentage points)



Source: Bloomberg

30. When considering the need for international reserve buffers in mature markets, a distinction should be made for reserve currency issuers and those with predictable access to reserve currency. Reserve currency issuers are unlikely to need sizable reserves for precautionary purposes as, in theory, they can create assets which can be swapped into any other currency at any time. This principle applies to both originating countries and countries with relatively predictable access to reserve currencies through central bank swap lines. The recent global financial crisis underscored the central importance of reserve currencies, and especially the US dollar. During the crisis several central banks used liquidity swap lines provided by reserve issuers (especially USD

swap lines) to meet short-term dollar funding needs of banks and stem market dysfunction. However, while temporary USD swap lines were put in place promptly for core countries with coverage and terms flexibly adjusted to help them cope with sudden deterioration in the market, the size, timing of setting up, and duration of the USD swap lines was less flexible for central banks outside the core.

31. Mature market economies, without reserve currency status, tend to hold higher reserve levels particularly if they have rigid exchange rate regimes. Data suggests a median ratio of reserves to GDP of 53 percent at end-2012 relative to 3 percent for floaters. This could reflect reserve accumulation under a peg when they receive inflows (as has recently been seen in Denmark). However, they could reflect the need for buffers to maintain the peg. In fact, with full capital mobility and deep financial markets, maintaining a fixed exchange rate regime may require a very large war chest to defend the peg or risk a costly and disorderly exit from the peg, as the experience of the UK abandoning the ERM in September 1992 has demonstrated. Mature markets with flexible exchange rates, by comparison hold relatively limited reserves but, as discussed above, the risk of market dysfunction suggests that they may need reserves as well. The remainder of this section outlines the considerations which should be taken into account when assessing reserve needs for mature economies with flexible exchange rates, but who do not have predictable access to reserve currency swap lines.

32. Smaller and medium-sized AMs, particularly those with large financial systems, used reserves during the Lehman shock and some subsequently saw the need for higher reserves. Authorities cited *financial stability* and *market dislocation* as key precautionary motives for holding reserves, allowing them to readily provide the financial system with foreign currency liquidity or stem market dysfunction. Box 2 presents the experience of Australia and Sweden.

- The need to assist with *potential funding needs of the banking system* is particularly important for banking systems with significant assets and liabilities in foreign currency, and the associated maturity mismatches that could exit. The Committee on Global Financial Stability (CGFS) has documented how the build-up of such mismatches within and across currencies was a major vulnerability that was exposed by the dislocations in funding markets that have occurred since 2007. The CGFS notes that having adequate foreign exchange reserves during the crisis helped to alleviate pressures, though this self-insurance comes at a cost.[12] In addition, there may be a need to consider funding risks for systemic non-bank institutions tax.

- As discussed above, *past experience suggest that dysfunctional funding and foreign exchange markets typically last between two to three weeks*. However, policymakers in many mature markets following the Lehman crisis maintained some of their FX liquidity support operations for considerably longer than this. For instance, the Riksbank only terminated its U.S. dollar lending facility at end-2009. Officials therefore viewed funding conditions as remaining challenged for a

[12] CGFS Papers No. 37. The Functioning and Resilience of Cross Border Funding Markets.

much longer period of time. The duration of the market dislocation is a key consideration for setting the bounds for the amount of buffers needed while keeping the cost of holding reserves down. Such a dislocation motivation could potentially point to a relatively broad coverage of reserves, with reserves seen as mitigating the economic and financial impact of the financial stress.[13]

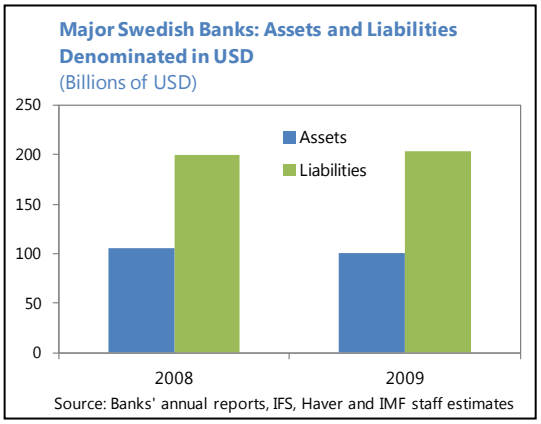
33. While reserves may serve as a useful backstop, they can only go so far in limiting risks. The first-best approach to addressing financial stability concerns is through macro- and micro-prudential tools, which should be deployed to reduce financial stability risks arising from banks' foreign currency liquidity needs. Appropriate prudential policies limit the risks the system poses for the wider economy, and this view is consistent with the responses from mature market authorities to our survey that prudential requirements play a more important role than reserve buffers in guarding against financial stability risks.

34. These considerations suggest the possible need for a foreign currency liquidity buffer held by the central bank, although precisely specifying the desired amount, or even desired sectoral coverage, remains challenging. While at a general level the concerns are market dysfunction and financial stability, a starting point could be to ensure sufficient foreign exchange liquidity buffers for banks since, historically, periods of funding and exchange market disruption have typically coincided with financial system stress (see Box 3). In particular, it would be prudent for authorities to insure against market dysfunction that could lead to the inability of banks to meet near-term FX liquidity needs, especially if banking systems are large relative to the economy, or to help restore the functioning of FX funding markets. This would serve the financial stability purpose, and limit the potential for negative spillovers to the real economy (Figure 8). Nonetheless, in some cases augmentations may be needed to sufficiently mitigate the economic impact given that for some countries the non-banking entities could also pose a systemic threat. For instance, experience since 2008 has shown that non-bank entities (e.g., investment banks, insurance companies, and mutual funds) can be closely interconnected and systemic. These entities may also face short-term funding stress in the face of market distress and hence may also need to be considered.

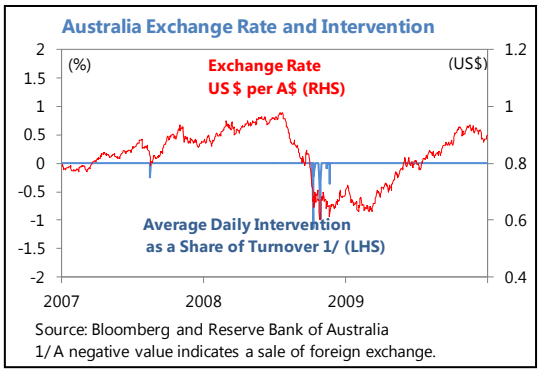
[13] Australia and New Zealand both see market dysfunction as the basis for possible intervention, the potential need is based on broader considerations, e.g., "the optimal level of reserves can be considered as that which *enables sufficient capacity to mitigate economic and financial shocks*, while minimizing the opportunity costs and risk exposures that reserve assets generate." (RBA, 2012)

Box 2. Reserve Use During the Global Financial Crisis: Sweden and Australia

Sweden presents a timely case to derive lessons on how to consider the size of foreign reserves. Its financial system is large relative to the economy, and the system's four major banks have sizeable foreign currencies activities, especially in Euros and US dollars. Moreover, these banks rely on wholesale funding markets to finance some of these activities. A currency breakdown of the aggregate balance sheet of the major banks indicates a sizeable gap between U.S. dollar assets and liabilities. The Riksbank increased its reserves during the global financial crisis to support a dollar lending facility, which they expect to reflect banks' potential foreign exchange liquidity needs, which have increased in nominal terms.[1]



Both the Fund and the Riksbank have estimated foreign reserve needs using proposed Basel liquidity ratios as a guide. The Riksbank applied scenario analysis to banks' euro and dollar funding needs, estimating the system's need for FX liquidity on top of net cashflow needs that coincides with banks' combined liquidity coverage ratios (LCRs). Under the baseline scenario, banks have already started using their liquidity buffers before the central bank intervenes. The banks are then unable to convert half of their most liquid assets but are unable to issue government-guaranteed debt. The Fund's estimated reserve needs are based on an estimate of the required stable funding necessary to meet the 100 percent net stable funding ratio, and so capture possible funding need over a one year time horizon in a period of extended stress.[2]



The Australian authorities view the need for intervention, and hence reserves, to be centered on market conditions. Initially after the Australian dollar floated in 1983 this meant mitigating volatility "to lessen its effect on the economy" in light of some market participants' limited capacity to cope with volatility.[3] This motivation has migrated to one of addressing market dysfunction. Nevertheless, the RBA continues to retain the discretion to intervene to address gross misalignments of the exchange rate, even where market conditions are orderly. During the global financial crisis, the AUD market came under stress with poor liquidity and the AUD dollar losing value in a manner of one-way price movement. In order to address such dysfunction, the RBA intervened in the market by selling US dollars, on some occasions continuously for a few days. Although the criterion is less clear than funding needs, it is a critical stability motivation for holding precautionary reserves.

[1/] See Riksbank, Financial Stability Report 2012:2 and Monetary Policy Report October 2012. The Riksbank also pointed to increased commitments to the IMF.

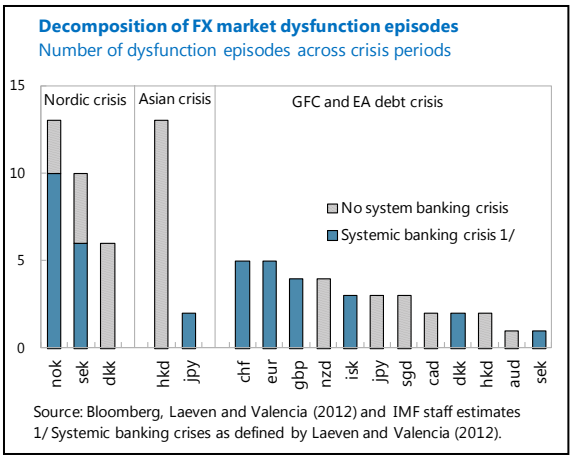
[2/] See Attachment III on Reserve Adequacy in the 2011 Article IV Report for Sweden.

[3/] Newman and others (2011).

Box 3. Market Dysfunction and Systemic Banking Crises

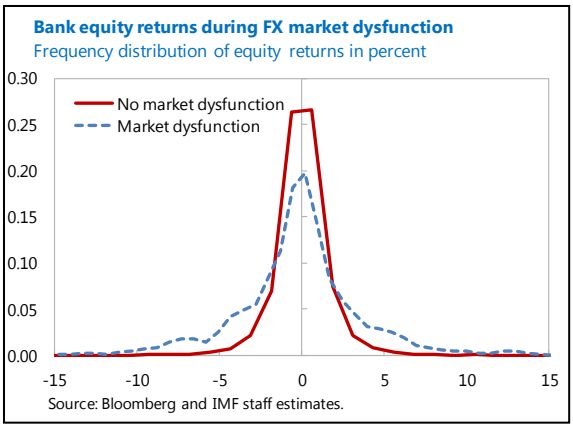
This Box reviews the relationship between banking system stability and the episodes of FX swap market dysfunction. It finds (i) stress in the FX swap market and in the banking sector tend to coincide; and (ii) bank equity returns also become more volatile during market dysfunction episodes.

Based on the Laeven and Valencia (2012) crises database, advanced economies covered in the sample experienced 9 systemic banking crises in 8 countries (plotted against FX market dysfunction episodes), between 1989 and 2012. Systemic banking crises lasted, on average, close to four years, much longer than the FX market dysfunction episodes discussed in Box 1. Systemic banking crises thus tend to coincide with a sequence of FX market dysfunction episodes: close to two thirds of FX swap market dysfunction episodes coincided or occurred in the year preceding a systemic banking crises in the 8 countries that witnessed such crises (with more than half coinciding).



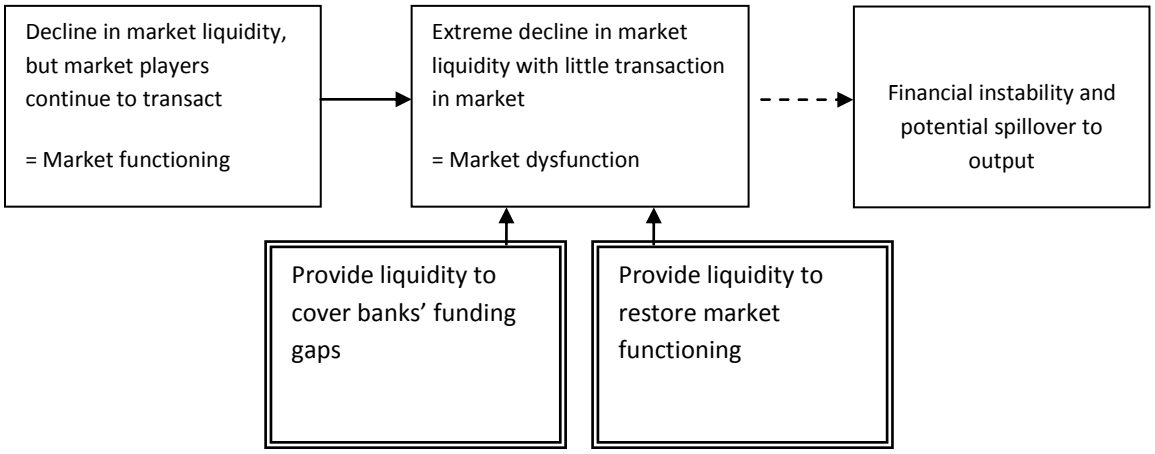
In the case of the Nordic crisis in the early 1990s, sequential market dysfunction episodes preceded the systemic banking crises in Norway and Sweden. While Denmark also experienced market dysfunction episodes, particularly in the first half of 1990, it was not followed by a systemic banking crisis.[1] During the Asia crisis, Hong Kong witnessed 13 episodes of market dysfunction, but did not experience a banking crisis. In contrast, Japan faced a systemic banking crisis in November 1997, which was followed by two short-lived episodes of FX market dysfunction in October-November 1998. The fact that several periods of market dysfunction were not followed by a banking crisis, in part, reflects successful efforts to stem the market dysfunction. During the GFC, all market dysfunction episodes in Denmark, the euro area, Iceland, and the UK coincided with the systemic crisis (the banking crises in Switzerland and Sweden narrowly failed to be classified as systemic).

Looking at high frequency data such as bank equity returns to evaluate the relationship between banking sector stress and episodes of FX market dysfunction shows that bank equity returns are significantly more volatile during such episodes. The standard deviation of the daily returns (in percent) more than doubles, while losses at the 10th percentile nearly triple relative to losses under normal market conditions. In the days immediately preceding dysfunction episodes, bank equities are on average registering losses of about 1 percent per day—somewhat higher than that for non-financial corporates.



1/ The housing and banking crisis did not evolve into a systemic banking crisis as measured by Laeven and Valencia (2012).

Figure 8. Determining Reserve Needs



35. In this context, new liquidity regulations proposed by the Basel Committee on Banking Supervision (BCBS) may provide a guide to the amount of buffers needed by aiming to ensure that banks have sufficient high quality liquid assets (HQLA) to survive against stress scenarios lasting up to 30 days, which roughly coincides with the duration of past events of funding stress[14]. In cases where foreign currency mismatches are an important feature of banking systems, the BCBS recommends monitoring the Liquidity Coverage Ratio (LCR) for significant currencies. Indeed, some countries have or are considering going beyond monitoring and adopting a foreign exchange LCR as a standard. This suggests the central bank could hold a buffer of highly liquid foreign currency assets sufficient to meet any LCR shortfalls in the banking system over some duration of a stress scenario in significant currencies,[15] provided that FX funding risks outside the reach of LCR are not significant. In other words, the central bank would effectively hold a stock of HQLA that would be consistent with an additional common pool of the LCR standard for the banking system as a whole, and possibly for some systemic non-banks.

36. Extending this argument, reserves could, at a minimum, provide an important buffer in (i) the transition period to the full adoption of the new liquidity standards, where gaps may emerge in compliance within a banking system, and (ii) during periods of stress when banks may need to hold less than the 100 percent LCR standard. The LCR will be phased in from 2015, but will only reach 100 percent in 2019.[16] Regulators recognize that the standards are not likely to be met by all banks at all points, and hence sufficient liquidity buffers may not be available during a

[14] The BCBS also recommends the net stable funding ratio (NSFR), a standard for covering a stress scenario for 1 year. However, discussions on the modalities and time for implementation of this standard are still on-going.

[15] Should a central bank hold reserves against potential liquidity risks posed by banks, the could also provide an incentive for banks to limit such risks by passing on the cost of these reserves in line with risks to banks.

[16] This graduated approach is designed to ensure that the LCR can be introduced without disruption to the orderly strengthening of banking systems or the ongoing financing of economic activity.

particular period of stress. In these circumstances some form of backstop, such as a buffer centered around possible short-term foreign currency needs, would seem a prudent consideration and could reduce the potential perception of a banking system's vulnerability to a liquidity/funding shocks. Because the LCR is a new, and as yet untested, standard it is difficult at this point to be definitive about whether it will be sufficient. As such, this is an area for additional empirical work as data on bank (and non-bank) liquidity positions become available.

37. Beyond the narrow needs of the banking system, central banks may have to consider other measures of need during times of market stress. Specifically, the functioning of the market can be gauged through the lens of trading liquidity, the behavior and positioning of market participants, and to some extent via a detailed analysis of balance of payments in order to try to distinguish from core transactions and versus interdealer and pure speculative trading. Gereben and Woolford (2005) have proposed the following strategies:

- **Trading liquidity** can be characterized by size, bid-ask spread, and speed of execution. Ideally, central banks can keep track of the typical amount of trading volume that occurs in a trading day, a history of the size of a single trades in a day and the bid-ask spread in which they were executed, and the time interval between execution. Since trading liquidity can dry up quickly in a shock scenario, a good understanding of the trading dynamics over time could guide the amounts of potential backstop a central bank could need to reinvigorate a dysfunctional market.

- **Behavior of market participants**, which would include a knowledge of market maker position limits, any important order flow and option positioning data, and an understanding of the currency needs of important economic actors that would prevent a stoppage of their vital business operations. Position limits would provide a guide as to the key market makers risk-taking capacity, and the point at which trading may become too one sided to allow for further transactions without intervention. Order flow and option information may shed some light into key exchange rate levels that may trigger cascading effects which could prompt actors to all sell simultaneously. Value-at-risk triggers have been known to have similar effects.

38. While the three approaches documented above (banking liquidity, trading liquidity, and market behavior) could help inform mature market reserve needs, they also point to significant data gaps for easy computation and comparison. With regards to the Basel LCR, standards for public disclosure requirements are still being developed,[17] and it is unclear what will be disclosed regarding major foreign currency exposures. Public disclosure would improve transparency about a bank's net cashflows and buffers, potentially reducing uncertainty about banks' exposures, and strengthen market discipline. With regards to trading liquidity, empirical studies have struggled with the lack of good data on foreign exchange trading volumes, bid-ask

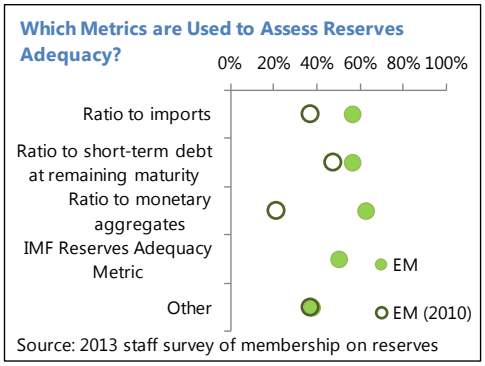
[17] The Basel Committee issued a consultative document on disclosure standards on the LCR in July 2013, with responses due by mid-October. See http://www.bis.org/publ/bcbs259.htm

spreads, etc. at high frequencies. Data on the electronic trading platforms or FX dealer's proprietary systems would be helpful, but access is limited due to confidentiality concerns and the proprietary nature of the data for the firms that run the platforms. With regards to positions limits and the information from important actors in the FX markets, it is likely that only the authorities may have the legal ability to access such information.

Proposal: Our results suggest that international reserves can serve as an important buffer for mature market countries that are not reserve currency issuers. Bank foreign exchange funding needs may provide a basis, but this could be augmented to reflect measures of trading liquidity and market participants' behavior, and possibly the foreign exchange liquidity needs of some non-banks. Nonetheless, computation of all three elements is complicated by significant data gaps, which inhibit broad based and specific guidance on reserve needs for mature market economies. Hence, as an initial proposal we suggest these three approaches be monitored by central banks as a basis for assessing reserve needs, and that efforts be made to fill data gaps, aiming to provide aggregate data to aid comparability.

II. Refining Advice for Economies with Less-Mature Markets

39. EM respondents to our survey report using a range of metrics—with roughly equal frequency—to capture reserve adequacy, including the metric developed in ARA. This section reconsiders whether the level of precautionary reserves suggested by traditional metrics and the ARA metric were sufficient in light of the global financial crisis. It also asks whether the weights used in the ARA metric were appropriate and the components captured adequately the liquidity risks faced by emerging markets. The analysis provides the basis for further refining the approach to assessing reserve adequacy, including through ensuring sufficient country specificity. As in ARA, we focus on measures of adequacy rather than the optimal level of reserves. This reflects a recognition that optimality models are highly sensitive to the assumptions used, and the desire to maintain guidance which is simple and transparent. The section ends with a discussion of reserve demand analysis, which can inform the motives for accumulation as well as identify reserve holding out of line with similar countries.



A. The Experience Since Lehman

40. Across EMs, reserves holdings have returned to pre-crisis levels. External liabilities, against which adequacy is measured by the ARA EM metric (Box 4), have also been relatively stable. Consequently, across EMs adequacy remains much as it was pre-crisis. However, there is significant variation at the country level (Figure 9).

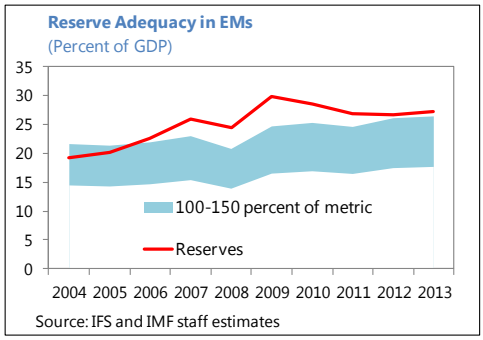
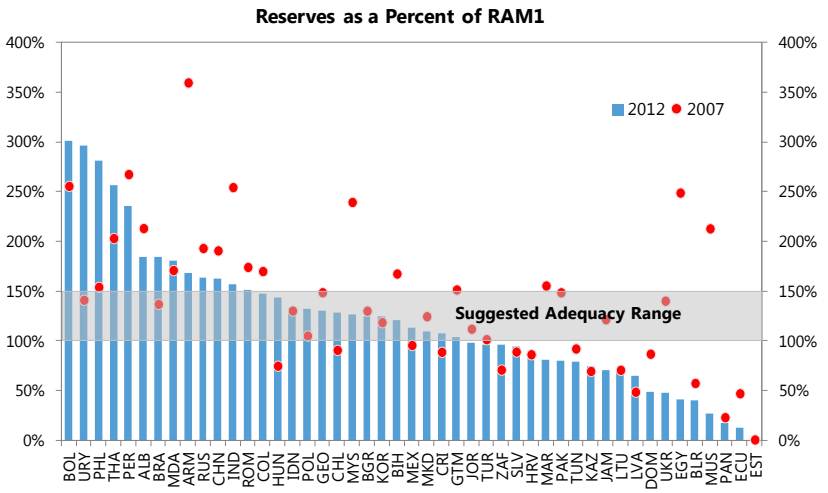


Figure 9. Reserves in Percent of the ARA Metric, 2007 and 2012[1]



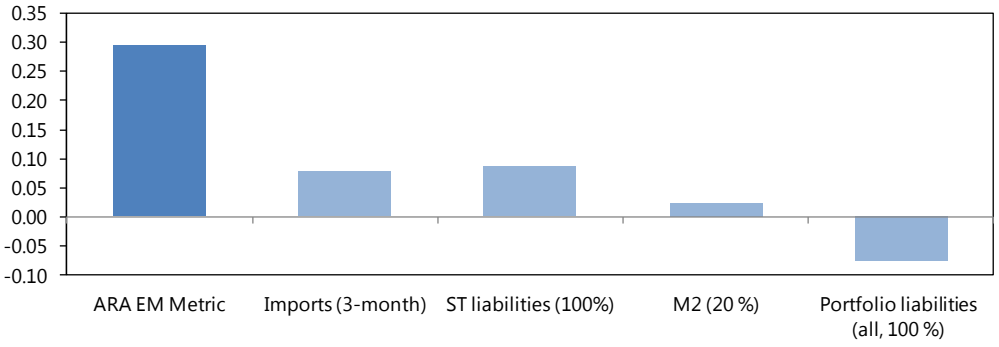
Source: IFS, WEO and IMF staff estimates

1/ The ARA metric used to prepare this chart applies the full weight on M2, but the presence of capital controls lowers the risk of capital flight, reducing the precautionary level of reserves needed against these possible outflows.

41. Overall reserves have had an important role in smoothing consumption in these countries (Figure 10). A cross-sectional regression used to explain consumption volatility over the period since the global financial crisis, found that terms of trade volatility, exchange rate flexibility, and accumulated past current account balances were all significant explanatory factors. In addition, reserve adequacy, as measured by the ARA EM metric, was found to be an important (statistically and economically significant) determinant. In particular, countries with reserves much below 100 percent of the metric generally suffered larger consumption falls after the Lehman shock. Countries with reserves levels above 150 percent of the metric experienced minimal marginal reductions in the probability of facing exchange market pressure, or drop in consumption.[18] Adequacy as defined by other traditional reserve metrics did not seem to be as significant, but typically indicated lower consumption volatility.

[18] The regression covered 2008-12 and 44 EMs. Independent variables are terms of trade change volatility, FX regime, current account balance, various measures of reserve adequacy (natural logarithm to count non-linearity), current account balance (5 year average prior to the sample period), cross term of current account balance and reserve adequacy, and cross term of ToT volatility and FX regime. See Chapter 6 of the supplement to this paper for details.

Figure 10. Estimated Coefficients of ARA Metrics *



Source: IFS ,WEO and IMF staff estimates
* Bold bar is significant at 5 percent.

42. Most countries with adequate reserves before the crisis, maintained their reserve adequacy after the crisis. Using the ARA metric to determine countries' reserve cover, most countries (25 out of 29) that were above the level of the ARA metric in 2007, also remained above in 2012 (Figure 9). A similar pattern is seen across other metrics (Table 2).[19] The distribution of countries below relevant metrics is also little changed between 2007 and 2011. However, there are also several countries that increased reserve holdings substantially while a few others experienced considerable reserve losses.

Table 2. Countries Above Relevant Adequacy Threshold

ARA EM		Short-term Debt		M2		Imports	
2007	2011	2007	2011	2007	2011	2007	2011
29	28	29	33	39	38	39	40

[19] The stability of reserves relative to these metrics does not contradict with the observation in the previous paragraph. As uncertainty about the duration and the ultimate depth of the global financial crisis as well as risk aversion increased, fear of losing reserves—precautionary motivation—led EMs to supplement the partial depletion of reserves right after the Lehman shock with significant exchange rate depreciation. For details, see Aizenman and Sun (2012).

Box 4. The EM ARA Metric

The EM ARA metric sought to broaden the analytical basis for determining the level of reserves needed for precautionary purposes. Traditional measures of reserve adequacy—such as import or short-term external debt coverage—focus on a particular set of potential balance of payment risks and give disparate results. The ARA metric was designed to reflect a broader range of potential pressures as highlighted in ARA. Specifically it covers:[1]

- **Short-term debt** (remaining maturity).
- **Medium- and long-term debt and equity liabilities** account for external liability stocks. Debt liabilities include both bank and portfolio liabilities.
- **Broad money** to represent resident capital flight risk.[2]
- **Export earnings** to reflect the potential loss from a drop in external demand or a terms of trade shock.

The relative risk weights for each potential source of outflow used in the metric are based on observed outflows from EMs during periods of exchange market pressure. Specifically the potential outflows are computed from the distribution of the annual percentage loss of export income, short-term debt, other longer-term liabilities, and broad money observed during such exchange market pressure events. Separate distributions are estimated for fixed and floating exchange rate regimes, identifying differing risk levels, with final weights based on the observed tenth percentile outflows. There also appears to be little correlation between the types of outflows (Table).[3]

Reserves in the range of 100–150 percent of the composite metric are considered adequate for precautionary purposes.

As discussed in the 2011 ARA paper, tested against actual crisis and exchange market pressure experience, the ARA EM metric outperformed traditional metrics. As reported in Chapter 6 of the supplement to this paper, these results are largely unchanged with the longer sample period.

Correlation between ARA Metric Components, 2008-2012

	ST Debt	Other Liabilities	Broad Money	Exports
Short-Term Debt	1			
Other liabilities	-0.2	1		
Broad money	0.1	0	1	
Exports	0	0.1	0.1	1

1/ Since this metric covers almost all elements of the balance of payments, with a specific proposal for commodity importers presented below, there is no need for a separate metric for countries with current account deficits. Moreover, risks associated with substantial and persistent current account deficits are, ultimately, best addressed through adjustment.
2/ As noted in ARA, the weight on M2 could be reduced (or even eliminated) where effective capital controls are in place that would prevent capital flight. The weight on other liabilities could also be reduced.
3/ While there is no sign of significant correlation between the broad elements of the ARA EM metric, for only three countries there is a significant correlation between broad money and debt liabilities due to intervention policies. For these countries, the metric implies a higher need for reserves than otherwise.

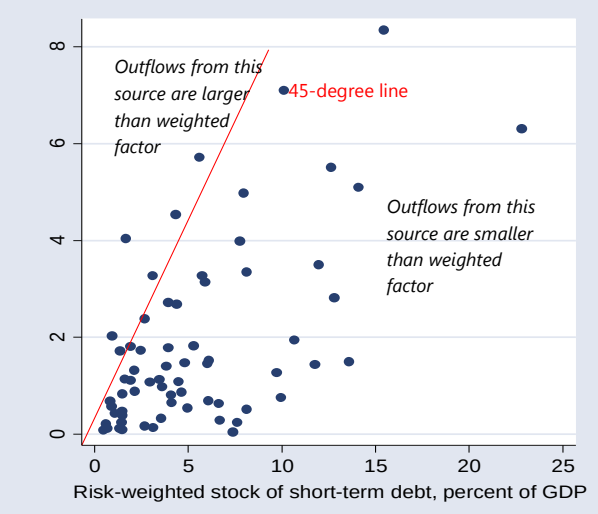
43. Recent experience since the crisis suggests the ARA EM metric, and the related risk weights, were broadly appropriate, with the possible exception of exports. Figure 11 plots the country-year pairs of actual drains relative to potential drains which compose the metric after September 2008 when reserves fall. The logic behind the approach taken to EM reserve needs in ARA was that reserves should be held jointly against multiple sources of possible external pressure, reflecting patterns seen in past crises, and that uncertainty should be captured through the 100–150 percent adequacy range. In particular, it was not expected that countries would always see drains against each of the individual components of the metric that are smaller than the corresponding weights. Consequently, comparing reserves loss to the change in individual metric components would seem a conservative benchmark with which to assess post-2007 experience. In general reserve drains in any year since 2007 have been lower than the "risk-weights" applied to each of the factors in the ARA EM metric. Overall, there have been few changes more extreme than these "risk weights," which are in turn based on EM experience up to and during the most recent crisis; for example, outflows from short-term debt were not large relative to previous crises. Exports, however, are the exception in that some countries saw a fall in export earnings that was much larger than suggested by historical EM exchange market pressure episodes. While this likely reflects the fact that the global finance crisis involved an almost unique shock to global trade, there may be a need to rethink the coverage of exports in the ARA metric. The period since May 2013, in which some countries with relatively high reserves holdings came under pressure, reinforces the message from Part I that while adequate reserves provide important insurance, this insurance, by itself, cannot not always entirely offset vulnerabilities resulting from weak policies or fundamentals.

44. While the cases of reserves loss since 2008 have not been extreme relative to other liabilities,[20] some countries have had large declines in the portfolio liabilities specifically (Figure 12). Most countries experienced an outflow in portfolio equity liabilities in 2008, averaging a 26 percent decline. As such, there may be a case to consider an alternative decomposition of longer-term liabilities of a country, or a higher weight on other liabilities.

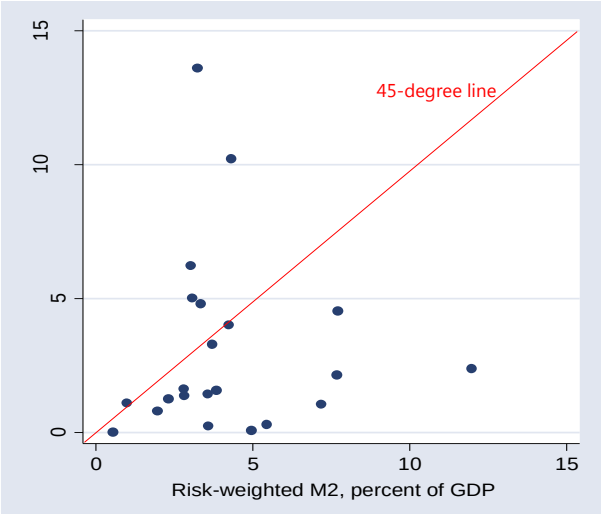
[20] For the ARA EM metric other liabilities are defined as portfolio liabilities plus other investment liabilities less short-term debt at remaining maturity.

Figure 11. Reserve Loss and Risk Factors

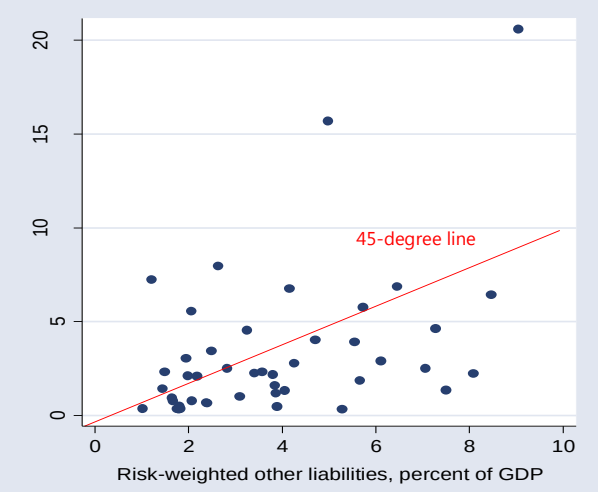
a. Short-term debt



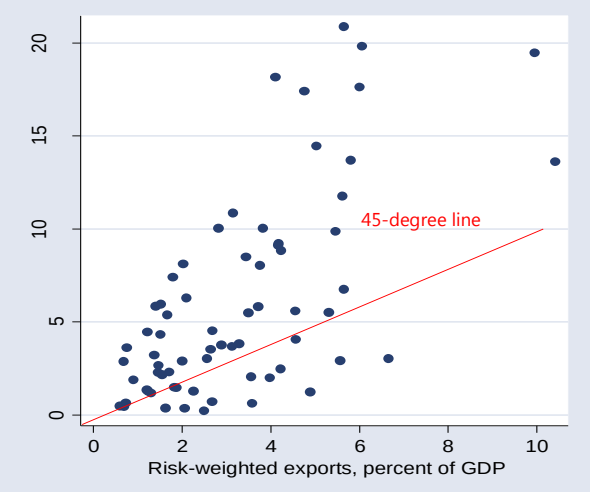
b. Broad money



c. Other liabilities

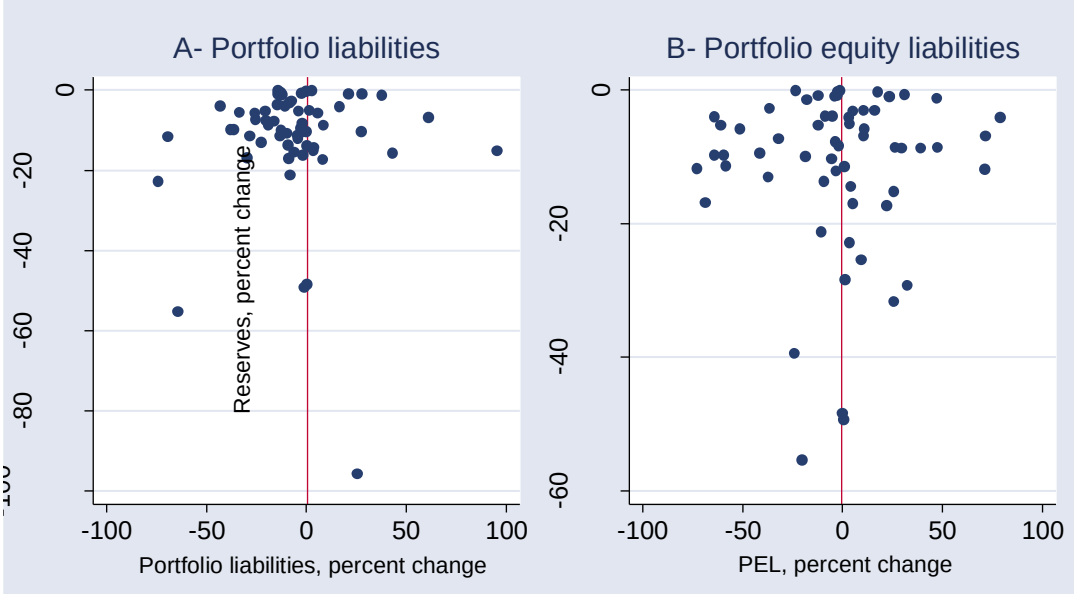


d. Exports



Source: IFS, WEO and IMF staff estimates

Figure 12. A Decomposition of Other Liabilities



Source: IFS, WEO and IMF staff estimates

B. Refining the Metric

45. Greater country-specificity could help improve reserve adequacy assessments. Specifically, we consider the following areas that were identified by Management and the Board following the 2012 IEO report: (i) risks associated with *portfolio investment*; (ii) risks to *commodity importers*; (iii) whether the ARA EM metric sufficiently captures the concerns of *commodity exporters*; (iv) how the *volatility* of flows should be captured in adequacy assessments; and (v) what guidance should be provided for *dollarized economies* (which is discussed later in section V). The work presented here will be the basis for a subsequent guidance note to build upon.

Portfolios liabilities

46. As outlined above, the risks associated with portfolio liabilities may not have been fully captured in the 2011 ARA EM metric. In ARA, medium-term portfolio (debt and equity) liabilities were combined with medium-term bank debt in a term named 'other liabilities.' An update of the analysis suggests, the tenth percentile outflows for countries with both fixed and floating exchange rate regimes are above the weights recommended in ARA. (Table 3; Figure 13). For comparison we also look at a separation of other liabilities into its components—portfolio equity and medium and long-term debt liabilities (Table 3).

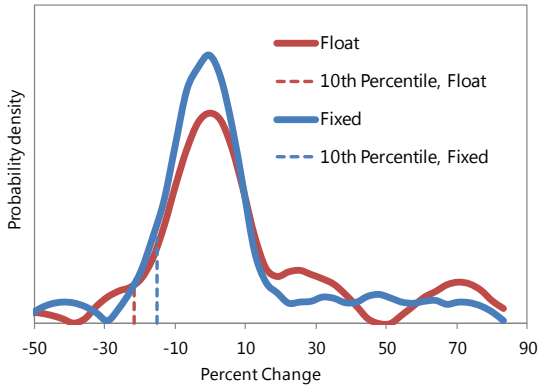
Table 3. 10th Percentile of Loss in ARA Metric Component, by Exchange Rate Regime

10th percentile (by exchange rate regime)	Other liabilities (OL)	Portfolio equities (PEL)	Medium and long term debt (MLTD)
ARA1		*Sample: 1980-2008; Data: IMF (2011)*	
Fixed	27.6	n.a.	n.a.
Floating	9.2	n.a.	n.a.
ARA2		*Sample: 1980-2012; Data: Aug. 2013*	
Fixed	23.1	15.1	23.8
Floating	11.6	21.5	11.8

Source: IFS, WEO and IMF staff estimates

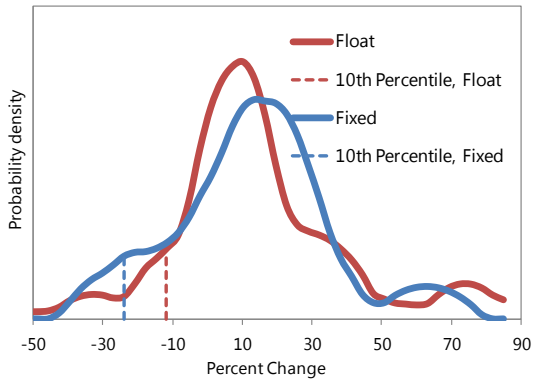
Figure 13. Equity and Debt Liabilities Changes during EMP Events

a. Portfolio Equity Liabilities



Source: BOP , WEO and IMF staff estimates

b. Medium and Long-term Debt Liabilities



Source: BOP , WEO and IMF staff estimates

47. The results suggest possible changes to the metric or its application to specific countries. One possibility is to raise the weight applied to other liabilities by 5 percentage points. An alternative possibility is to consider a metric which separates equity and debt liabilities.

Proposal: On balance, we propose simply increasing the weight applied to other liabilities. This has the advantage of maintaining the simple and transparent structure of the metric developed in ARA. Moreover, separately focusing on equity liabilities may well overstate the risks associated with these relative to debt liabilities. Unlike debt obligations (especially those in foreign currency), the pressure from equity outflows falls as their price declines and the exchange rate depreciates during the pressure.

Commodity Importers and Exporters

48. Economies heavily reliant on commodity trade may be particularly vulnerable to trade shocks, and this could be more concretely taken into account in the metric.

- *Commodity importers* tend to have highly inelastic demand and, hence, are vulnerable to potentially large swings in commodity prices. Indeed regression analysis (Table 4) suggests that the price elasticity for commodity importers is much smaller than for other countries.

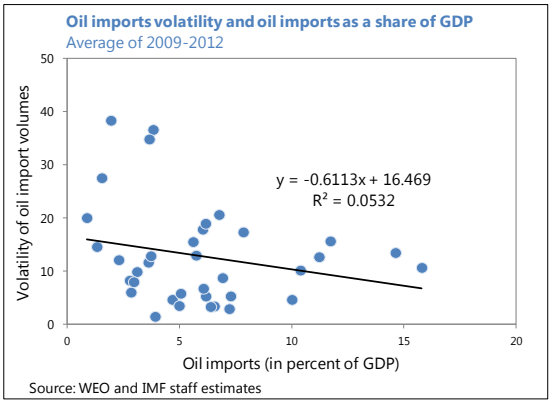


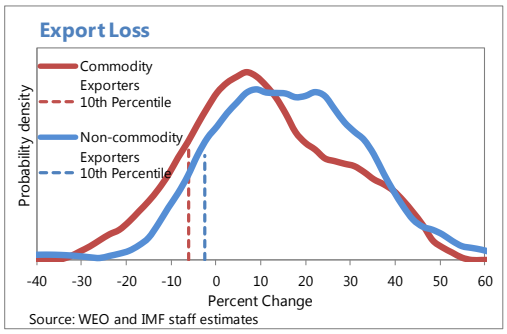
Table 4. Regression of Real Oil Imports on Macro Variables, 1980–2013 [1/ 2/]

Dependent variable: Volume of oil imports	Random effects (A)	Random effects (B)	Random effects (C)	Random effects (D)	Random effects (E)	Fixed effects (F)	Fixed effects (G)
Oil price	-0.221***	-0.252***	-0.275***	-0.313***	-0.286***	-0.315***	-0.284***
	(0.037)	(0.041)	(0.043)	(0.046)	(0.044)	(0.047)	(0.0445)
		0.407**	0.35	0.352	0.356	0.152	0.161
Real domestic demand		(0.205)	(0.222)	(0.222)	(0.222)	(0.232)	(0.232)
REER			0.315***	0.321***	0.314***	0.365***	0.353***
			(0.120)	(0.120)	(0.120)	(0.123)	(0.124)
Oil price * Commodity				0.270**		0.320***	
dummy (75th pct)				(0.119)		(0.123)	
Oil price * Commodity					0.335		0.419*
dummy (90th pct)					(0.223)		(0.232)
Constant	9.683***	8.347***	8.427***	8.004***	8.221***	8.784***	9.017***
	(1.102)	(1.484)	(1.617)	(1.624)	(1.622)	(1.652)	(1.652)
Observations	1,119	952	853	853	853	853	853
Number of countries	37	37	36	36	36	36	36
R-squared	0.03	0.04	0.05	0.06	0.05	0.06	0.05

1/ All variables in percentage change.
2/ Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Proposal: There may be a case for countries highly dependent on commodity imports to hold additional reserves when the price of the imported commodity is below the estimated long-run level, and hence expected to rise. Operationally, a component based on commodity import exposure could be added to ARA metric for vulnerabilities assessed for these economies. In this regard, the additional component added to metric could reflect the gap between the annual commodity import bill under current prices and under the expected long-run prices projected by a relevant source (e.g. WEO, country-specific panel of experts, etc).

- *Commodity exporters* may also be more vulnerable than suggested by the weights applied to economies in the ARA EM metric. Using the list of countries whose export revenues are mainly based on fuel and primary commodities, as provided by the IMF World Economic Outlook (WEO),[21] we found that the tenth percentile for export losses is 6.1 percent for commodity exporters relative to 4.7 percent for the pooled sample, and 2.5 percent for non-commodity exporters.



Proposal: The weight applied to exports in the ARA EM metric could be adjusted upward specifically for countries heavily reliant on commodity exports.

Volatility

49. Some country authorities have pointed to the recent rise in the volatility of financial flows as implying the need for additional reserves. Portfolio and bank-related flows have been both large and volatile in absolute terms in recent years. These trends have seemingly led to greater liability flow volatility relative to the ARA EM metric (i.e., well below the average level of volatility in the later sample), reflecting higher capital flow volatility for some specific economies (Figure 14).

[21] Also includes Brazil, Colombia, and South Africa as commodity exporters.

Figure 14. Volatility of Capital Flows and Reserve Adequacy Metric

Source: IFS, WEO and IMF staff estimates

50. For countries with a history of *highly* volatile flows, there may be a case to introduce some persistence in the desired reserve holdings. The ARA EM metric already captures the impact of capital inflows on reserve needs. Nonetheless, economies subject to especially volatile flows may also see rapid reversals in these flows. This suggests a case could be made to introduce some persistence in desired reserve levels for these economies.

Proposal: Introducing persistence to desired reserve levels could be a simple and parsimonious way to augment the existing adequacy assessment to reflect these additional vulnerabilities, as well as add to the country specificity in the advice on reserves. One possibility to operationalize this would be through maintaining reserves relative to some moving average of the country's metric level.

C. Implications and Relative Performance

51. Ensuring reserves are in line with the ARA for all EMs would add to global reserves, as would some of the proposed amendments. At the end of 2012, around 20 EMs had reserves below 100 percent of the ARA metric. Moving reserves to meet this level would add around $700 billion (6 percent) in demand to global reserves assets, around 2 percent of core-advanced economy bonds outstanding.[22] Similarly, amendments to the metric along the lines of those suggested above—raising the weight on other liabilities or exports—would add to the overall implied need for reserves, albeit modestly. Specifically, for those who would be below 100 percent of the revised metric, reserves would rise by less than $100 billion. Currently, the suggestion for commodity importers does not imply any additional need as medium-term prices (as projected by the WEO) are below their current level.

52. As in the 2011 ARA, we compare the performance of alternative measures of adequacy by comparing their association with periods of exchange market pressure, as well as other crisis events (past major EM crises, banking, currency, and financial crisis). Specifically we estimate a logit regression of these events, and see which measures of adequacy are best at predicting them. The measures include the traditional metrics, the ARA EM metric, as well as one based on the decomposition of other liabilities as described above (labeled ARA2). In virtually all regressions (see Chapter 6 of the supplement) the ARA EM metrics were found to be statistically significant in predicting the crisis event, in line with the results in ARA. By contrast, the traditional indicators of reserve adequacy—such as reserves in months of imports, reserves in percent of short-term debt, and reserves in percent of broad money—were generally inferior. The alternative ARA EM metric (which separates portfolio equity liabilities) is somewhat more significant and has a slightly higher signal-to-noise ratio, 2.7 compared with 2.4, but as discussed above complicates the construction of the metric.[23]

D. The Demand for Reserves

53. Reserve demand analysis can help inform peer comparisons of reserve adequacy as well as shed light on countries' motives for accumulating reserves. Elsewhere this paper has focused on identifying plausible shocks to the balance of payments, and determining the reserves necessary to provide a liquidity buffer against them. A complementary task is to use countries' observed reserve accumulation to infer their motives for holding reserves, and to assess adequacy on the basis of peer comparisons of reserves held for precautionary purposes. For EMs these precautionary needs cover both the current and capital account. In practice, beyond the reserves

[22] This is slightly more than the amount of reserves held by countries above 150 percent of the metric.

[23] In the signal-to-noise calculation, a "call" is made if the reserves-to-metric ratio is below 1.

required to back fixed exchange rate regimes and for precautionary purposes, countries may also accumulate reserves as a by-product of exchange rate policies, or from a longer-term savings motivation.

54. Recent Fund research extends the analysis of reserve demand presented in the 2011 Assessing Reserve Adequacy paper by considering both precautionary (country insurance) and non-precautionary (mercantilist) motives, and examining how these vary over time and across the distribution of reserve holders (Ghosh and others, 2012). The paper considers an expanded set of variables to proxy precautionary demand against current and capital account shocks, the exchange rate regime, and new proxies for mercantilism/currency undervaluation—including based on publicly-available information on the methodologies used by the IMF in its own exchange rate assessments.

55. Ghosh and others (2012) find that no single explanation can account for the behavior of all countries at all times. First, estimated regressions for the full period (1980-2010) and three sub-periods (1980-97 (pre-Asian crisis); 1998-2004 (post-Asian crisis); 2005-2010 (global imbalances)) show how motivations for EMs have changed over time (Table 5). In the first part of the sample (pre-1997), when reserve holdings and financial integration were low, insurance against current account shocks was the most important determinant. Not surprisingly, post-Asian crisis, insurance against capital account shocks gained greater importance as a motivation for holding reserves. In the post-Asian crisis period, moreover, reserves accumulation that was not obviously related to country insurance needs and accumulation undertaken in the context of undervalued exchange rates started to become more relevant. These trends continue in the final sub-period (2005-10), where coefficients on capital account variables and exchange rate undervaluation become larger and remain statistically significant.

56. Empirical analysis using quantile regressions finds that motives vary also across the size of reserve holdings. In particular, the desire for insurance against capital account shocks is more important for countries holding higher reserves relative to GDP (Table 5). The motivation for reserve accumulation in countries with relatively lower levels of reserves, by contrast, centers on current account shocks. Currency undervaluation seems to be relevant across the reserves' distribution, although it is possible that for some low-reserves holders this may be more a reflection of currency crises and collapsed real exchange rates than of undervaluation as a policy choice.

Table 5. Results from Reserve Demand Regressions

	Reserve demand over time			Reserve demand across quantiles (1980-2010)			
	1980-1997	1998-2004	2005-2010	25th pct	50th pct	75th pct	90th pct
Regime							
Hard and soft peg	0.308*	0.047	-0.103	0.066	-0.013	0.012	-0.019
Current account							
Log (imports/GDP)	0.684***	0.473***	0.454***	0.853***	0.614***	0.557***	0.371***
Capital account							
Financial openness	0.111*	0.123**	-0.025	0.154***	0.083***	0.038**	0.050***
Log (broad money/GDP)	0.200*	0.284**	0.445***	0.335***	0.320***	0.358***	0.377***
Short term debt to GDP	-0.399	0.481*	0.341*	0.504***	0.348***	0.105	-0.026
Mercantilist							
Exchange rate undervaluation	0.081	0.331***	0.335***	0.385***	0.203***	0.200***	0.177***
Oberservations	449	289	258	996	996	996	996
R-squared	0.428	0.519	0.532				
Pseudo R2				0.364	0.37	0.367	0.382

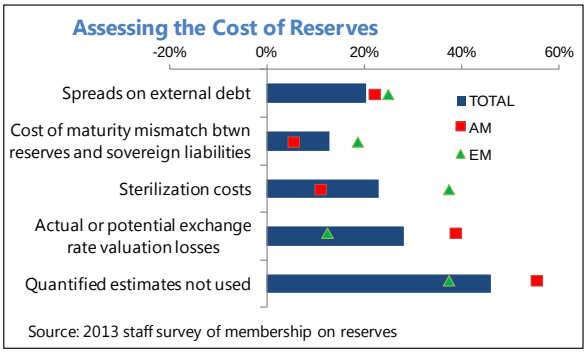
Source: Ghosh, Ostry & Tsangarides, 2012, Tables 1 and 2.

Notes: Dependent variable, log(gross international reserves/GDP). Other independent varibles include per capita income, population, volatility of neer and opportunity cost. Full model set out in Ghosh, Ostry & Tsangarides, 2012.

Robust standard errors where *** p<0.01, **p<0.05, *p<0.1

III. Cost of Reserves—Considerations for Market Access Countries

57. The accumulation of reserves can be highly costly. In general, the opportunity cost is defined as the difference between the yields on reserves and alternative opportunities. From the public sector's view point, three types of opportunity cost can be identified:[24] the spread between the return on reserves and interest paid to (i) either government bonds or bills issues denominated in domestic currency (i.e. sterilization cost), (ii) that issued in foreign currency (i.e. external debt servicing cost); and (iii) the social opportunity cost of public capital, which is the difference between the yield on reserves and social return on capital (often proxied by the local currency government bond rate).[25] Ultimately, however, all three measures come down to the difference between the return on reserves and a borrowing cost of the sovereign, whether in



[24] Rodrik proposes a different measure of external debt servicing cost, which incorporates private sector having a net open position in foreign currency (Rodrik, 2006).

[25] Due to the methodological difficulties with estimation precision, most papers make "heroic assumptions," such as using the return on domestic government bonds as a proxy or avoid the problem altogether (David Hauner, 2005),

local or foreign currency.[26] Possibly reflecting the fact there are a range of alternative approaches a large number of respondents (around 40 percent) reported not using any quantified cost measure in their analysis of reserves, although around a fifth reported several alternative methods (See Chapter 9 of the supplement).

58. The 2011 *Assessing Reserve Adequacy* paper focused on the "net financial cost" of holding reserves, which, for countries with external debt (denominated in foreign currency), captures the opportunity cost of reserves relative to their use to partly extinguish external debt. Specifically, this measure of the cost is the EMBI spread less the endogenous impact of higher marginal reserves on spreads (Levy Yeyati, 2008). *Assessing Reserve Adequacy* showed that for the median EM, the rise in reserve holdings has already been associated with a general convergence of this cost measure and the EMBI spread.

59. However, several countries with large reserve holdings have relatively limited externally issued debt and debt has increasingly been issued in local currency, suggesting that sterilization costs may be a more appropriate measure. For the median EM, the share of domestic debt in total public debt has been on the rise since the early 2000s, reaching near 70 percent in the last few years, coinciding with episodes of major capital inflows and reserves accumulation. However, central banks have increasingly attempted to sterilize the inflationary effect of the rapid reserves accumulation (IMF WEO 2007; Aizenman and Glick 2009), and when they have done so by issuing government bonds domestically, they incurred quasi-fiscal costs (Calvo, 1991).[27] As sterilization involves the central bank exchanging high-yield domestic paper for low-yielding reserves, an appropriate measure of the quasi-fiscal costs of sterilization is estimated by the difference between the return on longer term US Treasury bonds and domestic yields.[28]

60. Opportunity cost measures are also relevant for mature market economies which are not reserve currency issuers, but these costs are likely modest relative to those of EMs. For instance, authorities with the intention of holding reserves to deal with market dysfunction or as a foreign currency buffer to allow them to provide liquidity support will bear the cost of either financing, sterilizing the reserves they accumulate, or not investing in assets with higher return. Figure 15 depicts the difference in opportunity costs between mature market and less-mature market countries. The large difference stems from the difference in sovereign funding costs and

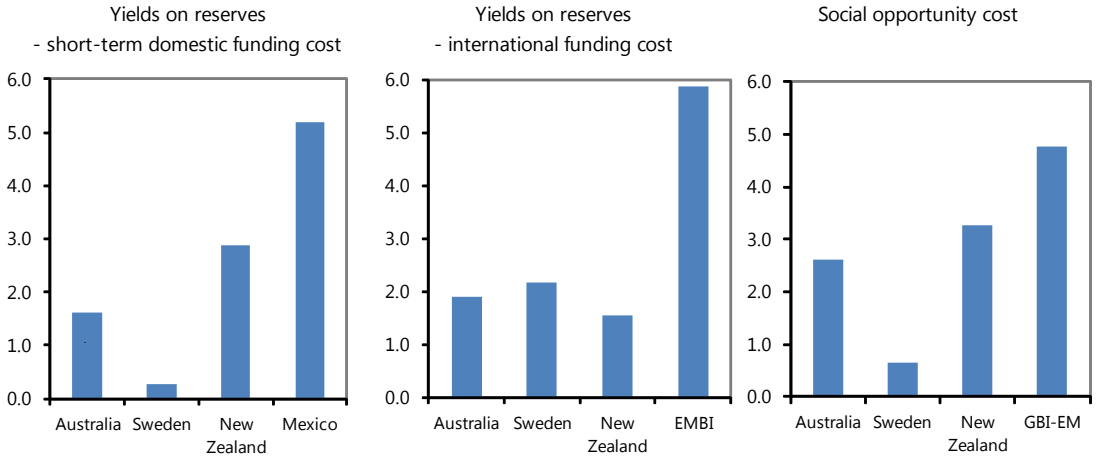
[26] The marginal opportunity cost of supra-prudential reserve holdings could equally be compared with total equity returns. This would be akin to managing reserves in different tranches: one highly liquid and safe for prudential reasons, and another for additional reserves in an investment portfolio. Over a longer ten year period (2003-12), the average total return on US and advanced economy equities was around 7-9 percent (the higher number reflects a world AM MSCI index). On this basis, the marginal opportunity cost of these reserves could be higher than that suggested by EM bond yields by up to 2 percentage points.

[27] Central banks also sterilize foreign exchange purchases by issuing central bank bills, or by reverting to non-market based intervention such as increasing the reserve requirement ratio.

[28] Countries with large reserve holding, possibly reflecting vulnerability to large shocks, could tier their reserve holdings—between highly liquid and liquid—to reduce the marginal cost.

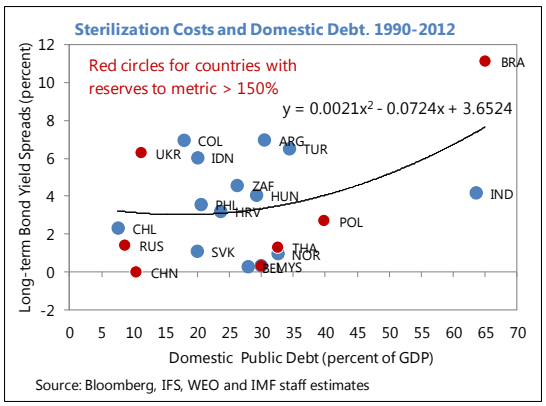
returns on domestic capital, given that the return earned by reserve assets is equal. AM sovereigns generally have relatively low funding costs in both foreign and domestic currencies. With regard to "public sector cost," EMs' opportunity cost stands at around 6 percent, the AMs depicted—Australia, Sweden, and New Zealand—having a considerably lower cost (around 2 percent).[29]

Figure 15. Opportunity Cost of Holding Reserves pre-, during, and post-GFC
(In percentage points)



Source: Bloomberg, IFS and IMF staff estimates
1/ Yields on reserves are the average interest on 3-month US T-bill and 2-year US treasury bond.
2/ Domestic funding cost is the interest on 3-month domestic bill.
3/ International funding cost is the interest on USD denominated international government bonds maturing between 2015 and 2017 for AMs and JP Morgan EMBI Global for EMs.
4/ Social cost is the spread between yields on reserves and 2-year domestic government bonds for AMs and JP Morgan GBI-EM for EMs.

61. Sterilization becomes increasingly costly. We estimate that increasing domestic public debt, including that associated with sterilization, raises the spread between yields on domestic long-term sovereign bonds and yields on US bonds.[30] More specifically, for a sample composed mainly of EMs we find that, beyond a threshold of domestic public debt to GDP (around 30-40 percent of GDP), issuing more government bonds domestically via sterilization activities raises the government's



Source: Bloomberg, IFS, WEO and IMF staff estimates

[29] This level is in line with assumptions in past literatures (Bird and Bird, 2002).

[30] Other costs of large stocks of sterilized reserves discussed in the literature, which we do not address here, include their distortionary effect on the domestic banking system and subsequently on the real economy. This occurs through crowding out of banks' lending activity either due to their holding of large stocks of government debt, or to their facing of higher reserve requirements when non-market based intervention is used (Lavigne, 2008; Cook and Yetman, 2012).

financing costs at an increasing rate, and suggests that corresponding to the benefits of adequate reserves, there can be significant costs once reserve levels become high.[31] The increasing marginal quasi-fiscal costs as sterilization-related debt rises are a partial reason why sterilization efforts are often temporary during episodes of capital inflows (WEO, 2007). This non-linear (convex) relationship between domestic public debt and yields continues to hold even after controlling for global risk aversion (captured by the VIX index), which also exerts upward pressure on domestic bond yields.[32, ,33]

62. The increasing nature of marginal cost reinforces the approach to EM reserve adequacy. As outlined in ARA and above, we have proposed an upper bound on the level of reserves which countries may consider adequate. This range reflects both an understanding that it is hard to be overly precise about the exact level of adequacy, and that the net-benefit of reserves declines at higher levels. In ARA this was demonstrated through declining marginal benefits. The analysis here reinforces this message, since the opportunity cost of reserves in domestic terms rises quickly at higher levels.

IV. Revisiting Reserve Adequacy for Credit Constrained and Low Income Economies

A. Background and Objectives

63. In 2011, the IMF (2011) developed a new approach to assessing reserve adequacy in LICs as a complement to reliance on traditional indicators, such as three months of import coverage. The approach focuses on the precautionary motive for holding reserves, seeking to balance the benefits from holding reserves in terms of both crisis prevention and mitigation against the opportunity cost of holding additional reserves.[34]

64. Survey findings indicate that this cost-benefit analysis approach to holding reserves is being used by a significant number of country teams, who indicate that more operational guidance would be useful, not least given the heterogeneity of LICs. Some teams noted the

[31] Please refer to the Chapter 8 of Assessing Reserve Adequacy – Further Considerations – Supplementary Information for more details on baseline regression and robustness checks.

[32] Our results are comparable to various studies in the literature on determinants of bond yields. Ardagna et al., (2007) find for a sample of OECD countries the same non-linear relationship between public debt and domestic bond yields. Jaramillo and Weber (2012) use a linear model and show that the effect of fiscal variables on domestic bond yields depends on the level of global risk aversion, with the effect much stronger in periods of heightened risk aversion (when market participants pay greater attention to country-specific fiscal fundamentals).

[33] In relation to Figure 16, our baseline results on the threshold effect are robust to dropping outliers such as Brazil and India.

[34] A crisis is defined as a large drop in absorption in the face of an external shock.

significant value of the approach in underpinning the policy dialogue with country authorities; others pointed to the need for greater clarity on how best to quantify the opportunity cost of holding reserves and others called for customizing approaches to estimating of the benefits of holding reserves to country circumstances, given the diversity of economic and financial structures across countries.[35] It was noted that the benefits of holding reserves would vary across such country groupings as resource-rich LICs (RRs), dollarized economies, small states, and members of monetary unions.

65. The next section focuses on the cost of holding reserves in LICs. An organizing framework is provided for determining proxies for the cost of holding reserves appropriate for different types of LICs. Since reserves typically accrue a return which must be netted from the cost, an approach for quantifying the country-specific return on reserves is presented.

66. The ensuing section proposes a refinement to the estimation of the benefits of holding reserves for resource-rich LICs. Given their high dependence on commodity revenues, RR exporters tend to face higher absorption losses than other countries in the event of a severe and prolonged decline in commodity prices. Re-estimation of the marginal benefits model yields a greater weight on the economic effects of shocks in RR than for non-resource economies.

67. A three step approach is then used to provide an illustrative estimation of the adequate level of reserves for LICs. This involves (i) estimating the cost of reserves (equated to the appropriate country group cost proxy); (ii) quantifying the country-specific return on reserves; and (iii) deriving estimates of adequate reserve levels using the estimated marginal cost of reserves (return on reserve assets less cost) and benefits.

B. The Cost of Holding Reserves

Conceptual framework

68. LICs vary significantly in terms of the level of financial sector development, the degree of access to international capital markets, the openness of the capital account, the extent of dependence on commodity exports characterized by high price volatility. All of these factors affect both the benefits and costs of holding foreign reserves.

69. The cost of holding reserves can be viewed through the narrow prism of the financial costs incurred by the central bank in acquiring reserves or from a broader economy-wide perspective. Three approaches are proposed for gauging the cost of holding reserves, not all relevant for all LICs:

[35] Please refer to the Survey Responses from LIC Country Teams in the the Assessing Reserve Adequacy – Further Considerations – Supplementary Information for more details.

- *The external funding cost for LICs that access capital markets*, net of the estimated return earned on foreign assets held as foreign reserves.

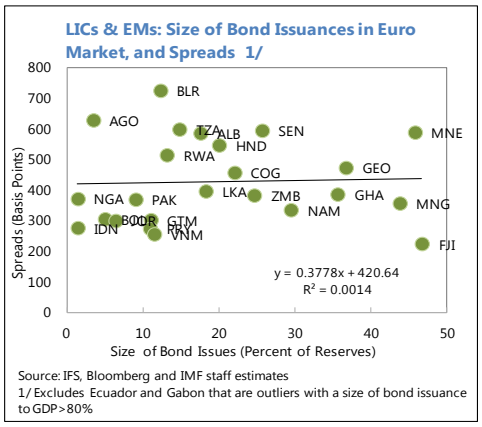
- *The sterilization cost that the central bank incurs when it purchases foreign exchange from the market*, again net of the return earned on foreign reserve assets. Comparing an interest cost denominated in domestic currency with the rate of return on foreign assets held as reserves requires some adjustment to account for exchange rate risk.

- *The opportunity cost to the economy as a whole of devoting investible resources into holdings of liquid foreign financial assets*. In this case, the marginal productivity of capital (MPK) provides an estimate of the foregone return from shifting resources from financing physical investment to holding reserve assets (see Box 5). In some cases where the state has command of significant resources held in foreign currency at the central bank – including several natural resource exporters -- the opportunity cost of holding reserves can be viewed as the marginal productivity of public investment (since governments see the choice as reducing reserves by one unit versus increasing public investment by the same amount).

Measuring the cost of holding reserves

70. Having established the basic approaches to gauge the cost of holding reserves, specific proxies are proposed, taking into account the liquidity of financial markets. Despite the simplicity of these approaches, choosing and quantifying an appropriate proxy can be difficult, especially when financial markets are distorted and segmented, undermining the informational value of different interest rates as measures of economic costs. Three proxies are suggested here: the yield on sovereign borrowing for LICs that access capital markets; the sterilization cost, adjusted for an exchange rate risk premium, for LICs with liquid government securities markets, estimated here as the exchange rate risk-adjusted return on the most liquid longer-term government bonds; and the marginal product of capital, in cases where financial markets are thin and underdeveloped.

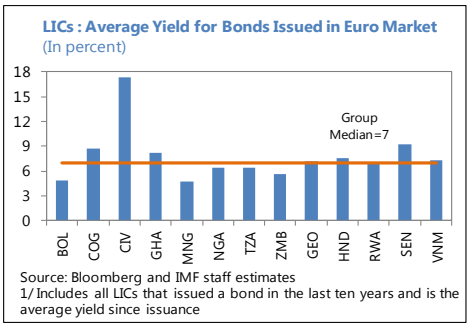
71. For LICs with market access, the external cost of borrowing can be approximated by the yield on the sovereign bond. The attractiveness of this proxy is that it is a market-based indicator which also captures the sovereign risk. However, this indicator could be biased: downwards if sovereign borrowing is collaterized or securitized by future commodity-revenues; and upwards if the government debt and probability of default are high.[36] Nonetheless, if sovereign bonds are tradable, the markets over time will reflect these factors in the sovereign risk premium. This is borne out by the



Source: IFS, Bloomberg and IMF staff estimates
1/ Excludes Ecuador and Gabon that are outliers with a size of bond issuance to GDP>80%

[36] The impact of high default probabilities on the sovereign risk premium would be captured in the benefits component of the LIC metric. See Levy Yeyati (2008) and Jeanne and Ranciere (2006) for details.

lack of a significant relationship between the spread and the size of the bond-to-reserve ratio in LICs and EMs (see chart). In cases where frictions prevent such corrections in the sovereign bond market, then a cross-country currency interest rate swap could be used. [37] The average yield on LIC sovereign bonds, issued within the last ten years, is about 7 percent (see chart).

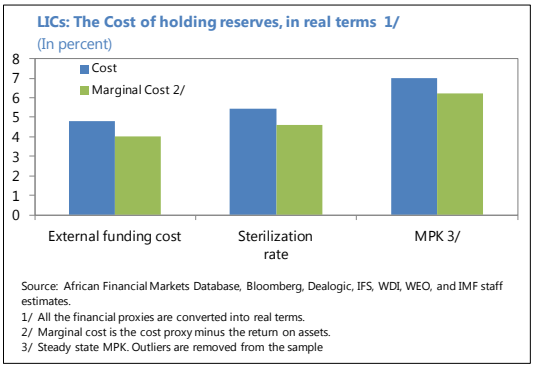


Source: Bloomberg and IMF staff estimates
1/ Includes all LICs that issued a bond in the last ten years and is the average yield since issuance

72. For LICs with developed financial markets, the return on government securities, adjusted for an exchange rate risk premium, is a useful proxy for the sterilization cost. Since most LICs do not have forward exchange markets, the risk premium could be computed using an average of historical real effective exchange rate depreciation. The decision on the specific maturity of government securities to use is probably best made on the basis of market depth, with a bias towards longer-term securities that are less likely to be affected by fine-tuning of monetary policies. If markets in government bonds and central bank securities markets are illiquid or significantly distorted, judgment is needed to determine which (if any) interest rates provide a good measure of sterilization cost.

73. For other LICs, lacking either external market access or developed domestic financial markets, the evolution of the output to capital ratio provides a good proxy for capturing the opportunity cost of foregone fixed investment (MPK). [38] It depends essentially on investment as a percent of GDP, output, the depreciation rate, and the share of the capital stock (Box 5). While the MPK (public capital) could be a useful indicator for RRs, measurement and data issues preclude country-specific estimates.

74. The marginal cost of holding reserves ranges from around 4 to 6 percent using the alterative cost proxies. The marginal cost is the lowest for LICs that have accessed sovereign bond markets at about 4 percent compared to 6.2 percent for LICs that do not have liquid government securities markets, for which the MPK approach was applied (see chart).



Source: African Financial Markets Database, Bloomberg, Dealogic, IFS, WDI, WEO, and IMF staff estimates.
1/ All the financial proxies are converted into real terms.
2/ Marginal cost is the cost proxy minus the return on assets.
3/ Steady state MPK. Outliers are removed from the sample

[37] This provides an estimate of the interest rate that banks are willing to take to enter into a cross-currency swap with another bank or client to exchange the local currency for a foreign currency during the tenor of contract.

[38] A survey of country authorities indicated that the opportunity cost of foregone consumption or investment was the most common approach used to assess the cost of holding reserves; the number of LICs included in the survey was, however, modest (See Chapter 10 of Assessing Reserve Adequacy – Further Considerations – Supplementary Information).

Box 5. Modeling the opportunity cost of holding reserves: Marginal Productivity of Capital (MPK)

The box outlines the theoretical underpinnings of the MPK used in the analysis. Typically, since reserve accumulation could be equated (without lost of generality) to saving, LICs are assumed to face two alternatives: i) keeping their saving in liquid and safe financial assets, (reserves) or ii) converting saving into productive investment. In that sense, the opportunity cost of holding reserves is equivalent to the marginal productivity of the investment forgone. Capital accumulation follows a law of motion given by

$$Kt \ = (1-\delta)K_{t-1} + \ I_t \ . \qquad (1)$$

where K_t denotes the physical capital stock, I_t the investment, and δ the depreciation rate of capital.

Under the assumption of competitive markets (good, labor, and capital) and a Cobb Douglas production function, output Y_t is given by

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \text{ where } 0 < \alpha < 1. \qquad (2)$$

The firm profit is given by $\pi_t = P_t\, A_t K_t^{\alpha} L_t^{1-\alpha} - r_t P_{kt} K_t - w_t L_t$ where P_t is the price of output (nominal GDP deflator), P_{kt} the price of capital good, w_t the wage rate, and r_t the real interest rate. Assuming competitive markets, factor earnings are proportional to their respective marginal productivities. α is the share of capital in output. Firm profit maximization yields the following first order condition for capital accumulation $\alpha \frac{P_t}{P_{Kt}} \frac{Y_t}{K_t} - r = 0$, which implies a MPK given by

$$MPK_t \ = \alpha \frac{P_t}{P_{Kt}} \frac{Y_t}{K_t} \, . \qquad (4)$$

For the empirical application, we consider two scenarios:

Scenario I: The economy is assumed to be at steady state (i.e., following a path with stable output and investment growth), and equation (1) (at the steady state $K_{ss} = (1-\delta)K_{ss} + \ I_{ss}$) implies $K_{ss} = \frac{I_{ss}}{\partial}$. Inserting this result in equation (4) (at the steady state) gives

$$MPK_{ss} = \alpha \frac{P_{ss}}{P_{Kss}} \frac{Y_{ss}}{\frac{I_{ss}}{\partial}} = \alpha \ \frac{Steady\ state\ nominal\ GDP}{\frac{nominal\ Steady\ state\ investment}{\partial}} \qquad (5)$$

The steady state investment and nominal GDP are inferred from the sample average during 1990-2018.

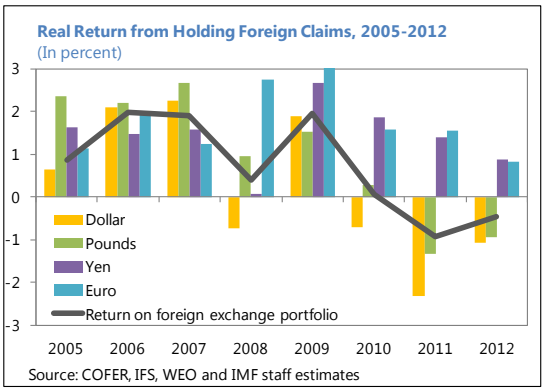
Scenario II: The economy is assumed to be on a dynamic transition path, and equation (1) is compounded recursively to determine the current stock of capital. This yields $K_t = \ (1-\delta)^t K_0 + \ \sum_{i=1}^{t} (1-\delta)^{t-i} I_i$ which is used in equation (4) to calculate the MPK.

To estimate the MPK, parameters could be calibrated as follows: the depreciation of capital δ is set to 0.04 following the average estimates from Bosworth and Collins (2003) and Arslanalp et al. (2010). The share of capital stock (α) is set to 0.3 following Aghion and Howitt (2007). For robustness, alternative δ and α values are also considered. The scenarios to calculate the MPK are valid as long as capital adjustment costs, which may reflect absorptive capacity constraints or cost overruns, are negligible.

The Return on Reserve Assets

75. The main objectives of reserve management in LICs are to invest in assets that are liquid and safe so that they can be quickly available for use following shocks. Central banks prefer liquid asset classes and deep markets as large sales of these assets have a marginal, if any, impact on prices. They also tend to invest in high-grade fixed income portfolios in highly-rated institutions due to the low credit risk. Cost minimization is a distinctly second order consideration.[39]

76. Central banks have traditionally invested in short-term bank deposits and government securities but in recent years these asset's low returns have contributed to a search for yields. The return on foreign exchange claims is estimated as the highest interest that could be earned from holding either government debt security or foreign bank deposits for the constituent currency. The one-year U.S. Libor rate is used for dollar claims and the government bond yield for the other currency claims.[40] Real returns are obtained by deflating the nominal returns using the constituent currency's inflation. The composite real return on foreign exchange holdings is computed using the share of the currency claims as weights. The real return has been negative in recent years largely driven by the dollar claims—these have been negative since 2010 as inflation has exceeded nominal returns averaging about 2.3 and 0.9 percent, respectively during 2010–12. Real returns on euro claims have declined from their peak of 3.1 percent in 2009, mainly due to a rise in inflation, but remain positive.



77. The strategy of focusing on safe and liquid assets has resulted in a negative real rate of return in recent years. Gold and reserve tranches at the IMF have no returns while SDRs earn the SDR interest rate. The negative real returns on reserve assets since 2011 can be attributed to declining nominal returns coupled with rising inflation.[41]

[39] In contrast, in some EMs where reserves seem to be higher than levels needed for precautionary motives the central banks are moving down the credit spectrum (e.g., real estate and private equity).

[40] The country that issues the currency's debt is utilized. The pound claims are long-term UK government bond yields. For the undisclosed currencies the US 1 year libor is used.

[41] The real return on holding reserves is computed by taking the nominal rate of return of the individual components of the reserve asset weighted by the share in the reserve asset portfolio and deflated by advanced economies inflation.

C. Reserve Adequacy in Resource Rich Economies: Marginal Benefits

78. The marginal benefits for holding reserves in RRs is adjusted to take into account the higher absorption losses that these countries tend to face in the face of adverse external shocks.[42] RRs tend to face higher absorption losses than other economies in the event of commodity price shocks due to their dependence on commodity revenues. This suggests that the marginal benefits of holding reserves may differ for RR and non-RR LICs. The estimation of the benefits of holding reserves in IMF (2011) is augmented with a dummy variable for RR economies. Regression estimates indicate that the magnitude of the absorption drops is much higher in RRs than in other countries, suggesting that RRs might need to hold a higher level of reserves to withstand external shocks (see Table).[43]

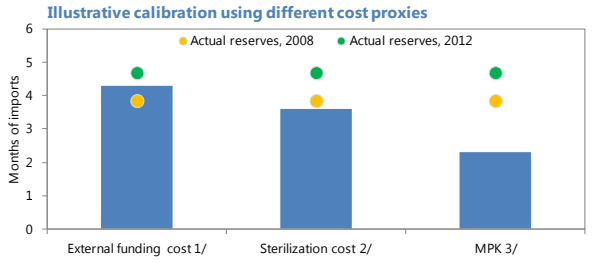
Magnitude of Absorption Drop
(Panel OLS Regression, 1990-2007)

	2011 Board Paper	Current work	AFR REO
Reserves, months of imports (t-1)	-2.240***	-2.257***	-2.257***
	(0.668)	(0.665)	(0.665)
Resource-rich	...	5.017*	10.573***
		(2.969)	(2.766)
External demand growth	-0.932**	-1.002**	-1.002**
	(0.436)	(0.428)	(0.428)
Flexible exchange rate regime (t-1)	-8.698***	-8.624***	-8.624***
	(2.169)	(2.173)	(2.173)
Terms of trade growth	-0.084*	-0.086*	-0.086*
	(0.048)	(0.048)	(0.048)
Change in FDI to GDP	-0.016	-0.023	-0.023
	(0.339)	(0.336)	(0.336)
Change in Aid to GDP	0.053	...	...
	(0.084)		
No.of observations	418	420	420
R square	0.34	0.43	0.42
Fixed Effect	Yes	Yes	Yes

Source: IFS, WEO and IMF staff estimates
Note: Standard errors are in parenthesis. *, **, and *** indicate statistical significance at 10, 5 and 1 percent, respectively. Reserves are measured in logs.

Determining the adequate level of reserves

79. An illustrative presentation of adequate reserve levels for LIC subgroups is provided to show the effect of alternative cost of reserve proxies.[44] The metric is calibrated for a typical LIC, using the estimated marginal benefits calculated with median economic fundamentals and shock values. As expected, higher marginal costs of holding reserves are associated with lower adequate reserve levels (holding marginal benefits constant). Specifically, a 2.2 percent difference in the marginal cost of holding reserves translates into a 2 months of imports difference in the adequate level of reserves (see chart).



Source: Bloomberg, IFS and IMF staff estimates
1/ The cost measure is based on the average yield on the sovereign bonds for LICS that have accessed markets.
2/ The cost measure is based on the treasury bill rate but the repo/reverse repo, money market and/or one-year treasury bonds rates are used where these are more applicable. The sample is limited to non-RR LICs with no market access but liquid government securities markets.
3/ The cost measure is based on the steady MPK.

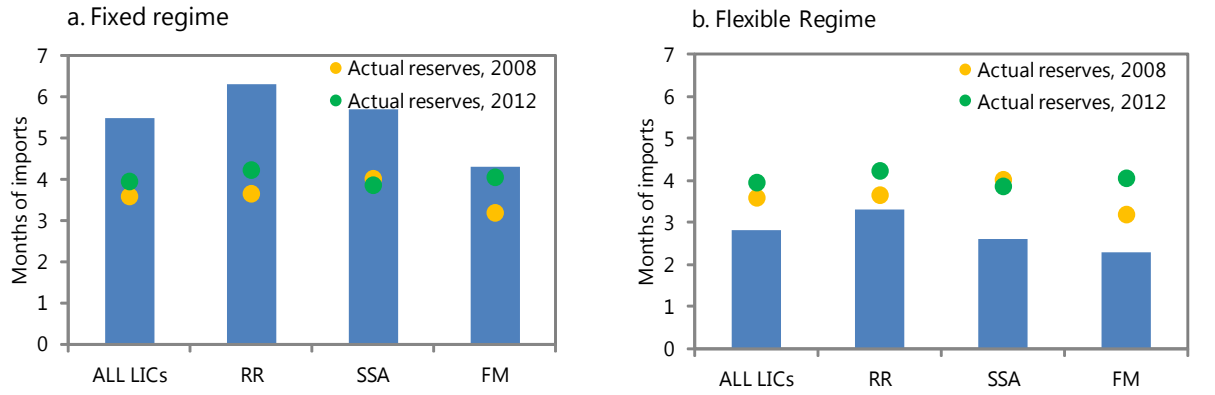
[42] This analysis is a follow-up from IMF (2012) which revisited marginal benefits for holding reserves in 13 RR Sub-Saharan African economies. In addition, the aid- to-GDP variable is dropped since it is not significant in helping reduce the absorption loss in RRs LICs.

[43] A similar analysis of the impact of reserves in reducing the probability of crisis found no difference between RR and non-RR LICs.

[44] For ease of presentation, the estimates of the benefits of holding reserves are based on the non-RR sample with a flexible exchange rate regime. The median level of reserves for a typical LIC is illustrated.

80. In the last five years, reserve coverage has been above three months of imports for both flexible and fixed exchange rate regimes but the assessment suggests that the latter could benefit from more reserve accumulation (see Figure 16). To capture the country heterogeneity in reserve need, the LIC metric is calibrated for RRs, frontier markets, and SSA subgroups.[45] The adequate level of reserves is higher for fixed exchange rate regimes due to their greater vulnerability to shocks. The adequate level of reserves for frontier markets is relatively lower than for the other sub-groups; on the one hand their cost of holding reserves is lower as they rely on external funding but their institutions are generally stronger and exposure to shocks is smaller. In general, reserve adequacy levels for RRs are relatively higher than for other sub-groups given the larger magnitude of shocks.

Figure 16. LICs: Illustrative Calibration of Adequate Level of Reserves for LICs



Source: IMF staff calculations
1/ Country groupings are as follows: RR= Resource rich exporters, SSA=Sub-Saharan Africa and FM= frontier markets. The SSA and FM groupings exclude RRs.
2/ The calculation assumes access to Fund-support following a shock

D. Application to LICs

81. The above framework for conceptualizing and measuring the cost of holding reserves is a refinement to reflect LIC heterogeneity, but as with other approaches, it cannot fully capture the range of factors that could affect the cost of holding reserves. Close examination of the balance of payments and the foreign exchange market could be useful to inform the judgment on the best approach to measure the cost of holding reserves. Sensitivity analysis could also be

[45] For each country group, the cost proxy/proxies that best capture(s) the approach used to accumulate reserves is (are) used. For example, the cost proxy for frontier markets is the average sovereign borrowing rate while that for RRs is the average of the sovereign borrowing rate and the MPK, weighted by the number of LICs that fall under each proxy.

undertaken on the MPK since rapid investment and capacity issues could affect the transition to the steady state.

82. The findings from the LIC country team survey suggest that other considerations may be needed in applying the LIC metric and in assessing reserve adequacy more broadly. Findings point to the need for a structured approach to considering adjustment of various parameters and also further operational guidance for using the metric. LICs with market access could supplement the reserve adequacy results with the EM-type metric as it captures capital flight risks. Future work could further explore the heterogeneity in LICs, including the high vulnerability of small states and mono-export economies to shocks.

V. Dollarized Economies and Currency Unions

83. Two particular types of currency arrangements which seem to transcend standard classifications are dollarized economies and currency unions. Considerations related to these exchange rate arrangements are discussed separately, with considerations for dollarized LICs discussed in Box 6.

A. Dollarization

Fully dollarized

84. While they do not have a separate exchange rate to defend, fully dollarized economies are still subject to BOP shocks requiring liquidity buffers in foreign currency, and which cannot be domestically generated.[46] Thus, while the specific purpose for such an FX liquidity buffer may differ from non-dollarized economies, aimed at assisting the domestic banking system, the external stress could manifest itself in any part of the external accounts. This raises the question of how different BoP risks could be identified. Since there are few dollarized EMs, the scope of detailed analytical work is limited. Hence, we consider the case of three fully dollarized economies—Ecuador, El Salvador, and Panama—and compare external pressure events with the components of the ARA EM metric.[47] Looking at changes in each metric component over the identified years, we place the three economies on the probability density distributions of each of the four components from the paper (Figure 17).

[46] Dollarized economies cannot accumulate reserves by issuing base money in exchange for FX assets. Instead, reserves accumulation is achieved through central deposits by another entity, such as the government (Kosovo, Panama) or a bank-financed liquidity fund (Ecuador), controlled by the Central Bank. Please refer to IMF Country Report 13/223 for more details.

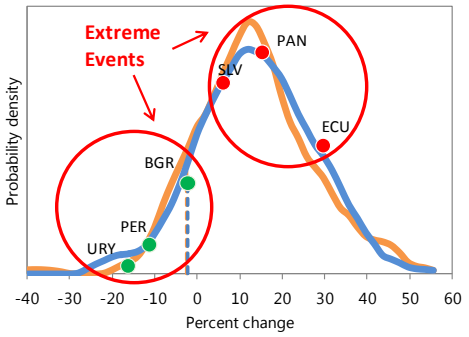
[47] Since we cannot use the EMP index to identify crisis years for these economies, we determine the most extreme fall in reserves based on the reserve assets change reported in the national balance of payments. We were unable to add some euroized economies, such as Kosovo and Montenegro, due to the short duration of their balance of payments data.

Proposal: In broad terms, our analysis suggests this metric may be a relevant, if not a conservative, benchmark even for these fully dollarized economies. We therefore recommend that, at a minimum, the metric might be perceived as a *lower bound* for reserve adequacy in these economies. In considering the adequacy of this amount, ex ante frictions in the usability of reserves—such as, in the case of El Salvador, limits on their usability of reserves for liquidity support operations—should be taken into account. Some dollarized economies (e.g., El Salvador and Kosovo) also augment their reserves held for external buffers with additional fiscal reserve buffers.[48] Should a government wish to hold specific fiscal reserve buffers, these should be held on top of the reserve buffers proposed by the metric, particularly if a large share of fiscal financing is from residents.

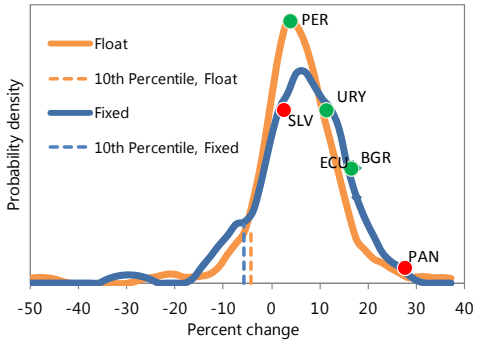
85. Overall, Panama and Ecuador have maintained reserves significantly below the metric's lower bound, while El Salvador's reserves have fluctuated near the 100 percent bound since its full dollarization in 2001. In light of this, it is interesting to note that in both Panama and Ecuador, import compression played a role in years of BOP drains when reserves were either partially used or not used at all. In El Salvador instead, import compression never played a large role.[49]

Figure 17. Potential External Drains in Dollarized Economies

a. Export Loss



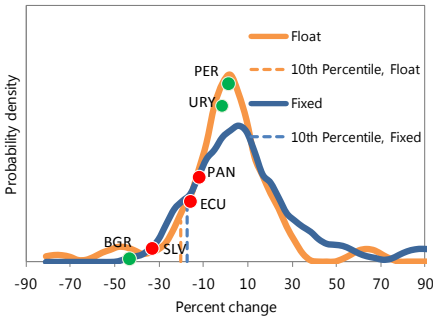
b. Broad Money Loss



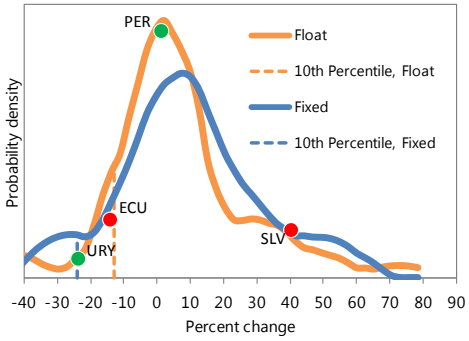
[48] IMF Country Report 13/223 (Kosovo) and IMF Country Report 13/132 (El Salvador).

[49] These results are based on an analysis of annual BOP data for each of these countries over 1980-2008, where we examine seven components of BOP flows, all expressed in percent of GDP: current account, capital flight (assets plus net errors and omissions), direct investment liability, portfolio liability, deposit and currency liability, other liability flows and reserve assets. Periods of BOP drains are identified–that is, periods of large capital outflows or non-resident deposit flight—along with corresponding behavior of the current account (import compression for instance) or reserves use or both.

c. Short-term Debt



d. Other Liabilities



Source: IFS, WEO and IMF staff estimates

Note: Red markers represent fully-dollarized economies; green markers represent partially-dollarized economies.

Partially dollarized

86. For partially dollarized economies where currency depreciation is an option, reserve adequacy needs, and its volatility, does not seem to differ substantially from in non-dollarized economies. As shown in Figure 17, aside from the potential loss of export income, countries with the most extreme partial dollarization—Bulgaria, Peru, and Uruguay—do not particularly stand out against other EMs based on the risk factors included in the EM ARA metric. Moreover, while Figure 18 shows that partially dollarized economies accumulated slightly more reserves (relative to metric) and experienced higher excess reserves volatility relative to other EMs, excluding the highly dollarized Uruguay eliminates any pattern.[50] Similarly, there seems little relationship between the extent of foreign bank participation in the economy and the extent of reserves held, or the volatility of adequacy. This likely reflects the fact that foreign banks often revert to their parents for funding during times of funding stress rather than rely on the host central bank.[51]

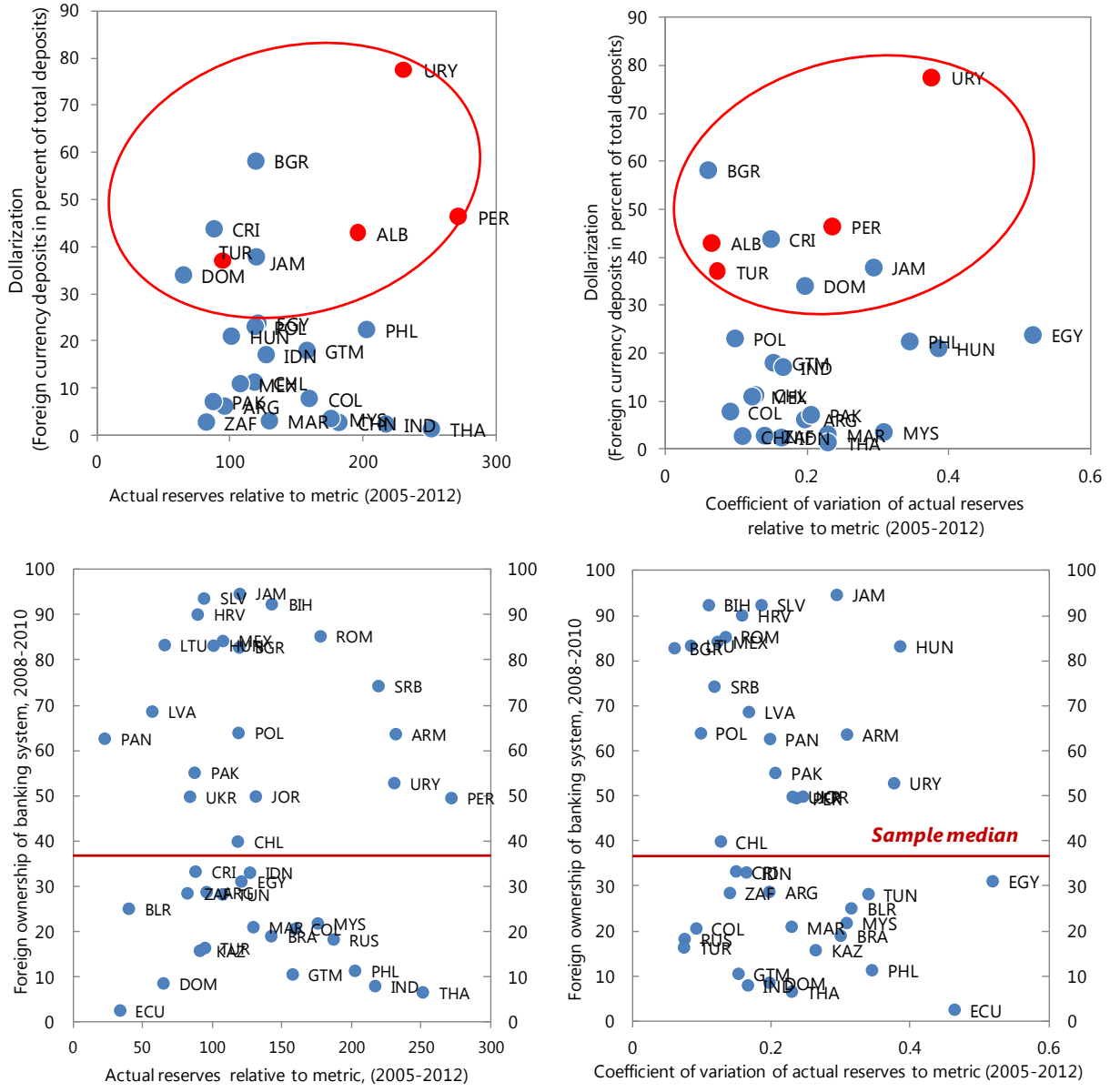
Proposal: The basic framework of the ARA EM metric seems to generally suit partially dollarized economies well given the high level of external (and externally denominated) liabilities.[52]

[50] We focus on asset dollarization, defined as share of foreign currency deposits in total deposits.

[51] This is particularly true for foreign branches which are legally entitled to support from parent banks during times of funding stress. Instead parent banks are not legally obliged to provide support to troubled subsidiaries, introducing uncertainty to parent-subsidiary burden sharing model and potentially suggesting higher need for reserve accumulation in host country central banks.

[52] Research on optimal reserves in partially dollarized economies (see Goncalves (2007) on Uruguay and Rodriguez & Funk (2012) on Costa Rica) apply a version of the Jeanne Ranciere model that accounts for deposit dollarization and for the observed (resident and non-resident) dollar deposit withdrawals during a crisis. This is captured in the ARA EM metric components of broad money and other portfolio liabilities.

Figure 18. Reserves Adequacy and Dollarization



Source: IFS and IMF staff estimates

Box 6. Dollarized LICs

Dollarized LICs may need to hold reserves, though their sources of external drains and ways of smoothing shocks differ from non-dollarized economies and depend on the nature and degree of dollarization. The key issues that could affect reserve needs of dollarized LICs are outlined with a focus on how they may differ from other LICs.

Fully-dollarized LICs

Although fully dollarized LICs do not require reserves to smooth excessive exchange rate fluctuations, they may need them to stem a liquidity crisis.[1] [2] Dollarized LICs could opt to acquire reserve buffers that could be used to provide liquidity in the face of a bank run. However, since fully dollarized economies tend to be small islands that face capacity and credit constraints, the credibility of the liquidity support could be limited. A deposit insurance scheme could provide stronger confidence to help stem a liquidity crisis since banking systems tend to be primarily financed by deposits. Furthermore, these economies tend to have a single deposit-taking institution that is owned by the government or foreign parent bank and could benefit from an implicit government guarantee or "imported" regulation and supervision, respectively.

Dual legal tender and other heavily dollarized economies

Economies with dual legal tender generally need to hold more reserves than non-dollarized countries due to their high exposure to exchange rate risk. While they may need relatively lower reserves to cover imports as residents already use foreign currency for transactions, they may face high exchange rate risk particularly if there is no de jure fixed exchange rate. In addition, if one of the dual currencies is a non-reserve currency, the risk of capital flight could be elevated (e.g., concerns about the rand could have implications in Lesotho). The lender of last resort role needs to be carefully managed to limit elevated risks of capital flight, which may warrant holding higher reserves. For heavily dollarized economies, moving from a de facto to de jure dollarization could help remove currency mismatch in the economy. Reserves cannot substitute for sound economic policies and heavily dollarized economies also need to focus on reducing macroeconomic vulnerabilities.

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[1]/ Dollarized LICs need to hold savings to address income shocks. Large external shocks could have significant income effects reducing the capacity to finance imports. Buffers could be held by the government since it is better placed to provide income support during a crisis and may be included as reserves depending on the institutional framework.

[2]/ Tuvalu, which does not have a central bank, has reserves in the form of government deposits and investment funds which are obtained from fiscal surpluses. Kiribati has no central bank and no reserve assets but has a sovereign wealth fund which it uses for fiscal financing in case of shocks. East Timor has a central bank and holds some reserve assets, as well as a separate sovereign wealth fund.

B. Currency Unions

87. Individual economies within a currency union, like all other economies, can be subject to balance of payments shocks. As such they also require external buffers, even if they have no currency to "defend." However, with a common central bank holding an adequate level of reserves and ensuring adequate liquidity within the union, there may be less need for individual members to cover their reserve needs through their own reserves. Indeed, to the extent that shocks are not entirely common, pooling reserves at the union level is likely efficient. The reserve assets should, as is typical with reserves, be invested externally in foreign currency, with the costs of maintaining reserves potentially charged differentially across the members of the union based on their contribution to overall vulnerabilities. The common central bank could provide foreign currency liquidity against pressure arising from particular members.

88. Nonetheless, the nature of the currency union is critical for the level of external buffers needed. Assuming reserve pooling can operate within a union, the considerations for reserve adequacy should reflect the underlying structure of the type of its members. More specifically, for currency unions able to issue a reserve currency, the reserve adequacy considerations at the union level should align with those for a reserve currency issuer. For those comprising EMs and LICs, reserve adequacy considerations should be in line with those for that type of economy. The West African and the Central African CFA francs are pegged to the euro and backed by the French Treasury, and so overall reserves should reflect the nature of these pegs (Delèchat and Martijn, 2007). By contrast, the Eastern Caribbean dollar is pegged to the US dollar, and supported by a quasi-currency board, with the monetary base consequently backed by international reserves (Dehesa and Druck, 2008).

89. However, the financial architecture and synchronization of some currency unions may limit the scope for heavy reliance on reserve pooling.

- *Financial architecture*. Inter-connected banking systems can also play a major role in the transmission of shocks from deposits outflows, and the needs for domestic liquidity provision. The absence of a banking union and the possibility that one of the members blocking the use of pooled resources by other members, as in the case of the ECCU, is a notorious limitation of these arrangements.

- *Synchronization*. If the members of a currency union lack sufficient economic diversification, the synchronicity of their business cycles may make them particularly exposed to a range of correlated shocks, limiting the value of pooling. Such shocks could include surges in food and fuel prices, plunges in FDI and terms of trade, and drops in the external demand of common trading partners.

90. In addition to the joint consideration of reserve adequacy, currency unions require other supportive policies. These include fiscal and banking unions with the purpose of providing a backstop to stem deposit flight, as well as a central bank able to provide domestic liquidity within the region (see Goyal and others, 2013). Without sufficient fiscal integration, and the limits on fiscal space due to the currency board arrangement, the adjustment to asymmetric shocks can be especially difficult (Dehesa and others, 2009). An example of the limited reach of pooled reserves was observed in the aftermath of the global financial crisis, when some ECCU members faced balance of payments pressures and had to resort to external assistance (including sovereign debt restructuring) and IMF support.

CONCLUSIONS

91. This paper succeeds the Fund's 2011 Assessing Reserve Adequacy paper, looking more deeply at factors which may affect the assessment of adequacy in specific country cases. Considerations on the adequacy for mature market economies are outlined, although the general implementation of these is impeded by the availability of data. The paper also finds that the advice on reserve needs for less-mature markets provided in ARA has been generally conservative. However, it suggests the possibility of some modifications relating to portfolio liabilities, and commodity intensive economies. For LICs, the paper provided more advanced and granular guidance on establishing a benchmark for the cost of reserves. The analysis contained here will thus form an important input into the planned guidance note.

92. A case is made that reserves bring significant benefits, although these decline at the margin, and are countered by their cost. For all types of economies reserves provide important liquidity buffers and reduce the risk of a crisis. This effect can, however, be offset by weak fundamentals leading to vulnerabilities including currency misalignment. Consistent with this, intervention, including in the form of meeting bank funding needs in foreign exchange, can be effective provided it is not aimed at defending an exchange rate out of line with fundamentals. The measures of opportunity cost of reserves discussed in the paper suggest that they become expensive at high levels.

93. The work in this paper will be used as a basis for the subsequent guidance note focused on operational issues. In particular, the guidance note will more clearly specify possible guiding lines for allocating countries by types of economy—mature, less-mature, frontier and credit constrained low income. It will also seek, subject to informational constraints, to better operationalize the three conceptual approaches proposed to underpin mature markets reserve adequacy needs. For less- mature and low income economies the guidance note will outline approaches to augment the standard metrics in ways to consistently capture country specific characteristics when assessing reserve adequacy. Nonetheless, an overarching objective in this work will be to maintain guidance which can be applied in a relatively simple and transparent way, as was advocated in ARA.

ISSUES FOR DISCUSSION

94. Directors may wish to consider the following issues:

- Do Directors agree that the ARA metrics provide useful guidance to EM and LIC country authorities on reserve holdings relative to traditional reserve metrics?
- Do Directors see the desirability of assessing a country's reserve needs by the maturity, depth and underlying liquidity of its markets as well as its economic flexibility, rather than by standard classifications (AM, EM, and LIC)?
- Do Directors view reserves as playing important crisis prevention and mitigation roles both in mature and less-mature economies?
- Do Directors agree that there is scope for the use of reserves to limit the pressure of outflows, although this scope depends on the adequacy of reserves, nature of external pressures, the extent of country-specific vulnerabilities, and the consistency of the domestic macroeconomic policy framework?
- Do Directors agree that many mature market economies may need precautionary external buffers, and that bank foreign exchange funding needs, measures of trading liquidity, and market participants' behavior may provide useful indicators of these needs? Should gaps in the availability of aggregated data needed to compile these indicators be filled quickly?
- Are the proposed augmentations to the work on the ARA EM metric worthwhile steps towards providing additional country specificity in reserve adequacy assessments? Does the metric provide a useful guide to the appropriate level of reserves, including for dollarized economies?
- Do Directors agree that the marginal benefits of reserves decline at high levels of holdings, and the marginal cost of reserves increases with reserve holdings?
- Do Directors see the benefit of the additional granularity provided on the cost of LIC reserve holdings?

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