Looking at aggregate currency mismatches and beyond

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Abstract

As a result of major reforms, aggregate currency mismatches in emerging market economies (EMEs) were much reduced in the decade or so before 2010. The lower sovereign credit spreads in international bond markets that resulted made it easier for companies from EMEs to borrow abroad. It also helped EMEs to face the turbulence related to the Great Financial Crisis of 2007-09.

Although they have increased since 2010, aggregate currency mismatches are no longer a problem in most EMEs. But this is almost entirely due to the stronger foreign exchange position of the official sector – higher forex reserves and less foreign currency-denominated government debt. Currency mismatches of the non-official sector are larger and measures reported in this paper provide an indication of their size.

In addition, a significant proportion of foreign currency bonds of EME local corporations have been issued by their financing vehicles located abroad. Such borrowing is not captured by residency-based statistics. In several cases, these overseas affiliates of EME local corporations have a rather limited productive and exporting capacity. For this reason, the measures reported here may significantly understate the true size of the recent increase in currency mismatches for EME corporates. This puts a premium on using as a complement information collected at consolidated group level – that is, on a nationality basis.

Keywords: currency mismatch, emerging markets, foreign currency exposure, financial stability.

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1. Introduction

Foreign currency mismatches have been traditionally seen as a key source of weakness for emerging market economies (EMEs), often triggering or aggravating financial crises. Some felt that EMEs would never be able to borrow abroad in their own currencies – the "*original sin*" view put forward by Eichengreen et al (2002). Yet a combination of macroeconomic reforms in the EMEs and better economic conditions confounded this initial pessimism. Moreover, in aggregate terms, the situation has greatly improved over the past two decades, and many no longer consider currency mismatches as a problem in most EMEs.

Yet correctly assessing the related financial stability risks posed by foreign currency exposures requires to look beyond aggregate numbers. First, not all countries are in the same position. Second, most of the improvement observed in EMEs has reflected the enhanced balance sheet position of the official sector; the situation of the private sector is less strong. Third, corporates in EMEs have increasingly issued foreign currency debt through their affiliates located abroad. Such affiliates are often located in international financial centres and have no independent exporting capacity. Hence, residency-based statistics may significantly understate the true exposures of the parent companies located in EMEs. These reservations underline the interest in looking at more granular data to better assess the risks posed by foreign currency mismatches.

Section 2 reviews the concept of currency mismatch and highlights the need to effectively monitor exposures to exchange rate movements. Section 3 presents an approach to actually compute indicators for measuring such currency mismatches, and Section 4 analyses the evolution of main emerging regions observed before and after the Great Financial Crisis (GFC). Section 5 shows how the concept of currency mismatch can be useful for assessing the full impact of exchange rates movements for emerging market economies. Section 6 reviews the limitations posed by the residency-based view of economic activity and Section 7 highlights the need for more granular information. Section 8 concludes.

2. Currency mismatch and exposure to exchange rate movements

BIS statistics have always been central to attempts to assess currency exposures. It was Andrew Crockett, then General Manager of the BIS, who suggested in the early 2000s the use of BIS's data on international banks and debt securities to construct measures of currency mismatches. He instigated at the BIS a systematic study by Morris Goldstein and Philip Turner of currency mismatches in emerging economies, and the results were published in Goldstein and Turner (2004).

The concept of currency mismatch is easy to state (even if difficult to measure). A currency mismatch between domestic and foreign currencies arises whenever an

entity's financial position is sensitive to changes in the exchange rate.[2] The "stock" aspect of such a currency mismatch is given by the sensitivity of the balance sheet to changes in the exchange rate; meanwhile, the "flow" aspect is given by the sensitivity of the income statement to these changes. The greater such sensitivity, the larger the currency mismatch. Typically, one will focus on the adverse impact of an exchange rate depreciation, since difficulties for EME domestic borrowers arise when they have a short position in foreign currencies – when the local currency depreciates, it is more difficult for those domestic borrowers to repay foreign currency debt, all else equal.

Box 1

External debt and foreign currency exposure

Debt measures can vary depending on the currency denomination and the residence of lenders, and each approach has its own advantages and drawbacks. The Goldstein–Turner concept of foreign currency exposures referred to in this paper differs from the concept of external debt in the national accounts framework because it (i) seeks to include domestic debt denominated in foreign currency and (ii) excludes liabilities to non-residents expressed in local currency. This "total foreign currency-denominated debt approach" is also the one followed by the BIS in computing debt-weighted exchange rate indices (see Berger (2016)).

In contrast, and according to the External Debt Statistics Guide (IMF (2014)), "*gross external debt is the amount, at any given time, of disbursed and outstanding contractual liabilities of residents of a country to non-residents to repay principal, with or without interest, or to pay interest, with or without principal*" (IMF (2014); cf #1.2). Accordingly, "*the net external debt position is equal to gross external debt less gross external assets in debt instruments*" (#7.50). This approach includes external debt denominated in local currency but excludes foreign currency-denominated debt to residents.

A second important point relates to the instruments being considered. Both the Goldstein–Turner foreign currency debt exposures concept and the external debt concept include only debt-like instruments. Equity-like instruments (including FDI) are excluded because they have no obvious foreign currency/local currency characteristics and are, in addition, not subject to similar repayment obligation as for debt-like instruments. This approach is different from the international investment position (IIP) of an economy, which "*is the balance sheet of the stock of external financial assets and liabilities, with the difference being the net asset (or liability) position*" (cf #1.4 and Appendix 4 of the External Debt Statistics Guide). As a result, the broader IIP concept encompasses equity instruments and not just debt instruments (see also Table A4.1 of the Guide for how these various concepts interact). This broader approach is typically followed for assessing the balance sheet of an economy and the valuation effects related to exchange rate movements (Bénétrix et al (2015)).

A last point to note is that the IIP also differs from the country's net worth, which includes non-financial assets – on these System of National Accounts (SNA) concepts, see also European Commission et al (2009).

It follows from this definition that it will generally not be possible to get a reliable picture of a country's aggregate currency mismatch by looking solely at the country's external balance sheet (as is often done by observers). Although they can be linked, *foreign currency exposure* is in fact not the same as *net external debt* (see Box 1). Because there has been much confusion on this point, it is worth clarifying when these two concepts would coincide. There are two necessary – but not sufficient –

[2] Hence, as mentioned by Gagnon (2014), a currency mismatch occurs when "*a household's or a firm's liabilities are denominated in a different currency from that of the future stream of earnings that are to be used to service those liabilities*".

conditions for equivalence between the concept of foreign currency exposure and external debt.[3] The first is that all debt contracts between residents (such as, for example, bond sales) be in local currency – that is, there are no internal contracts in foreign currency. The second condition is that all contracts of residents with non-residents be in foreign currency.[4]

These conditions are rarely met, implying that the concept of foreign currency exposure usually differs markedly from the concept of external debt. Many internal contracts between residents of the same country, especially in emerging regions, are in foreign currency; hence foreign currency exposure can arise despite a balanced external position at country level. Conversely, a significant part of EMEs' external liabilities reflects foreign purchases of their government bonds denominated in local currency. These external debt liabilities do not create foreign currency exposure, and they have indeed increased significantly in many EMEs in recent years with the development of domestic bond markets (CGFS (2007a)).

Moreover, the two conditions referred above are usually not consistent. For instance, if the second condition applies – that is, non-residents are prepared to buy a country's bonds only if denominated in foreign currency (eg dollar) and not in domestic currency – surely, some residents would also have a similar preference and would want to have domestic contracts in foreign currency. In practice, indeed, it is often residents in countries where there is little confidence in the local currency (or in the respect for local contracts) who buy a significant portion of the international bonds issued by their government. So it is quite unlikely to have a situation where both all contracts between residents are in local currency ***and*** all contracts of residents with non-residents are in foreign currency. Hence, there is no reason to suppose that aggregate foreign currency exposure should be equal to net external debt.

3. Measuring currency mismatches

Goldstein and Turner (2004) have developed a measure of aggregate currency mismatches in the economy as a whole.[5] The objective was to quantify the riskiness of foreign currency exposures of countries whose foreign currency debt liabilities exceeded their foreign currency assets. Their measure used data on international

[3] Here we focus only on the exposures/external debt of *resident* entities. As argued below (Section 6), one would also want to look at the exposures of national entities on a *consolidated* basis; this would represent a third factor of differentiation with the net external debt concept, which relies on the residency-based national accounts framework.

[4] They are not sufficient conditions because external assets could be in one foreign currency while external liabilities be in a different foreign currency. In this case, there would still be foreign currency exposures (independently of the given state of the net external debt) that would arise from movements in the cross-rates between foreign currencies. Because leveraged investors who wish to take calculated risks will usually borrow in a "safe", low-interest-rate foreign currency to hold assets in a higher-interest-rate foreign currency, this type of mismatch can be common.

[5] The Goldstein-Turner indicators have since been regularly used in BIS publications; see for instance Jeanneau and Tovar (2006), CGFS (2007a), CGFS (2007b), Mohanty and Turner (2010), Mehrotra et al (2012), Montoro and Rojas-Suarez (2012), Gadanecz and Mehrotra (2013), Devereux and Yetman (2014) as well as Chui et al (2016).

bank lending and bond issuance; on the currency of domestic bond issuance; and on the currency denomination of domestic credit.

An important element was that the Goldstein-Turner measure takes account of internal foreign currency exposures: that is, bank and bond financing in foreign currency from one resident to another. In fact, capturing such lending relationships is essential for financial stability analysis because a sharp currency depreciation can lead borrowers to default on FC debts to other residents. It is therefore important to avoid netting FC exposures that can arise within a country among domestic residents. Moreover, the measure follows the "economy as a whole" principle, ie it includes in the analysis all the resident entities of the country, whether foreign- or domestic-owned. As a result, this also means that these currency mismatch measures do not include entities that are located outside of the country (eg offshore financing vehicles) even if linked to domestic firms or households – a limitation that has become more serious with the increased globalisation of financial markets (as discussed in Section 6 below).

As detailed more fully in Chui et al (2016), an adequate measure of forex debt exposure should combine two distinct components of currency mismatches, the importance of the share of FC-denominated debt and the net foreign debt position.

The **first element** is the foreign currency share of total (ie domestic and external) debt, FC%TD, scaled against the share of exports in GDP, X/Y. The reason is that, ideally, the country should have enough FC revenues to service its FC debt. Hence, the foreign currency share of debt should be viewed in comparison to the share of tradables in GDP – Goldstein and Turner (2004) used total exports of goods and services as a proxy for this tradables share of GDP. The first, simple mismatch ratio is thus:

$$\frac{\text{FC\%TD}}{\text{X/Y}} \tag{1}$$

The reasoning is that countries with high export/GDP ratios can sustain higher foreign currency shares in total debt. The greater this mismatch ratio is – ie the larger the share of foreign currency debt is compared to the exports share – the more difficult the situation for the country can be: at some point, exports may not generate sufficient earnings to finance foreign currency debt servicing. A number of studies (eg Montoro and Rojas-Suarez (2012)) have highlighted the usefulness of such a simple mismatch indicator for analysing the resilience of economies to an external financial shock.

The **second element** to be considered for assessing FC exposures is the difference between foreign currency debt assets (FCA) and foreign currency liabilities (FCL) as a percentage of GDP. The mismatch ratio is:

$$\frac{\text{FCA–FCL}}{\text{Y}} \tag{2}$$

When a country has net foreign currency liabilities, its Net Foreign Currency Asset (NFCA) position – that is, assets minus liabilities (ie: FCA-FCL) – is negative. In that situation, any exchange rate depreciation has a negative balance sheet effect; that is, the country's NFCA, expressed in domestic currency, becomes more negative. The larger the net liability position relative to GDP, the greater this balance sheet effect. Of course, it is important to keep in mind the significant uncertainty (and revisions) affecting measures of financial assets and liabilities as well as the difficulty to adequately capture off-balance sheet exposures (cf Box 2).

Box 2

Computation of the Net Foreign Currency Asset position

To start with, the NFCA is calculated as the sum of:

- (i) the net foreign assets of the central banks and other depository corporations (that is, banks; source IMF-IFS);
- plus (ii) non-bank foreign currency cross-border assets with BIS reporting banks (source BIS locational international banking statistics (LBS));
- minus (iii) non-bank foreign currency cross-border liabilities (excluding debt securities) to BIS reporting banks (source BIS LBS); and
- minus (iv) non-bank international debt securities outstanding in foreign currency (source BIS international debt securities statistics (IDS)).

For a general introduction on the BIS statistics underlying these calculations, see BIS (2015) as well as BIS, FSB and IMF (2015). Note that (i) covers the net external positions of the resident banking sector, (ii) and (iii) cover the net assets of the non-bank resident sectors (excluding the debt securities they may have issued and that would be held by BIS reporting banks) vis-à-vis the foreign banking system, and (iv) covers FC debt securities issued by non-bank residents.

Obviously the measures computed are approximations based on a number of simplifications (in addition to the significant uncertainty – and revisions – affecting estimates of financial assets and liabilities)[6]:

- One is that (i) is assumed to be mainly in FC. Admittedly, this is more likely to be the case for EMEs compared to advanced economies (typically, EME external assets would be assumed to be in dollars). But this simplification is likely to significantly understate the extent of cross-currency mismatches.
- Second, most of the instruments covered by (ii) and (iii) are supposed to be debt instruments (excluding debt securities from the liabilities), noting that some limited part of the cross-border assets and liabilities captured by the BIS LBS can be equity instruments; and there may also be some potential double-counting with banks' positions as recorded in (i).
- Third, it is assumed that most international banking activity is captured by BIS reporting banks.
- Lastly, the FC exposures deriving from these reported balance sheet positions do not take into consideration potential hedging operations (see Section 7 below).[7] In particular, while central banks' FC positions comprised in (i) would typically not be assumed to be hedged, unhedged commercial banks' positions could be expected to be small due to supervisory requirements (admittedly, at the bank-consolidated level rather than on a residency basis). As regards non-banks' positions, anecdotal evidence suggests that aggregate country's exposures through derivatives contracts could potentially be large; this is noted by Gagnon (2014), who finds for instance that the economy with the greatest AECM computed using balance-sheet data in emerging Asia

[6] As recognised for instance in #12.27 of the External Debt Statistics Guide: "*the boundaries between debt and equity, and direct, portfolio, and other investment are subject to different interpretations, and also subject to error and mismeasurement*".

[7] The inclusion of derivatives varies across the data sources. As regards the next external debt, "*financial derivatives (…) are not included in the gross external debt position because they are not debt liabilities*" (#2.52). Derivatives are captured in the BIS LBS in general, but not in the subcomponents used here to estimate (ii) and (iii). As regards the IMF-IFS statistics used for (i), the net foreign assets should include financial derivatives. Yet their measurement is prone to uncertainty and variations across countries. Moreover, it is based on the value of the related contracts and will not capture their potential impact on exposures as recognised in the *Monetary and financial statistics manual and compilation guide* (IMF (2016); #6.142): "*analysis of the vulnerability of an economy's external debt position requires data beyond that provided by the IIP framework…*" including "*increasingly, extent to which financial derivatives are used to hedge, or even increase, exposure to risk*".

(Korea) has also the most developed derivatives markets. Yet, while Bénétrix et al (2015) recognise that cross-border currency hedging is difficult to assess, they also argue that it is typically advanced economies that engage in derivatives operations; this suggests that the related uncertainty for EMEs should be relatively modest.[8]

The resulting index for **aggregate 'effective' currency mismatch** (termed AECM) follows from the multiplication of the two mismatch ratios presented above:

$$\text{AECM} = \frac{\text{NFCA}}{\text{X}} \cdot \text{FC\%TD} \tag{3}$$

where: FC%TD = Foreign currency share of total debt;

X = Exports of goods and services;

NFCA = Net Foreign Currency Assets.

If foreign currency assets are exactly equal to foreign currency liabilities then AECM is zero – that is, there is no aggregate effective currency mismatch. This would be true even if FC%TD is high, as in a dollarised economy, where debts are largely denominated in dollars. If a country has a net liability position in foreign currency (ie NFCA is negative), AECM will be negative, and the country's net debt position worsens when the currency depreciates. The greater the foreign currency share of total debt, the greater the aggregate impact. Ratio (3) can thus be thought of as a stress test for assessing, in a stylised way, the overall impact of an exchange rate shock on the FC exposure of a country – combining the share of foreign currency in total debt with a measure of the country's net foreign currency position relative to its exports. Using this AECM concept, Gagnon (2014) shows that Asian EME economies have significantly reduced their vulnerability after the Asian financial crisis of 2007/08. Borio and Packer (2004) found that explicit proxies for currency mismatches do matter when explaining sovereign ratings.

Yet using summary indicators as proposed above has three notable caveats. The first is that a *more comprehensive assessment of the macroeconomic consequence of an exchange rate movement* should also take into consideration other factors. An important one is the competitiveness effect from currency depreciation, that is, the associated rise in real exports and fall in real imports. Traditionally, this leads initially to a deterioration of the nominal trade balance, followed in the longer run by an improvement depending on the country's specific lags and circumstances (eg the so-called Marshall–Lerner condition). Another important factor to be considered is that

[8] An assumption that seems consistent with the results of the BIS Triennial Central Bank Survey of foreign exchange and OTC derivatives markets in 2016 (http://www.bis.org/publ/rpfx16.htm), which shows that only 10% of global derivatives turnover is in contracts denominated in the currency of an EME. As argued by Upper and Valli (2016), "*derivatives markets for EME currencies and interest rates tend to be much smaller than their advanced economy counterparts* (…). *EME derivatives markets are also limited to a narrower set of instruments* (… and…) *there is reason to believe that residents of and investors in EMEs find it more difficult and more costly to hedge their exposures than their peers in advanced economies*".

the value of equity-like FC instruments and thus of the whole country's financial balance sheet will also be affected by the depreciation.[9]

The second issue relates to the word "*aggregate*": the AECM indicator is computed for an economy as a whole. Yet a specific aggregate may conceal sectoral (as well as intra-sector) differences in terms of net FC assets. For instance, the government may have a positive NFCA but the private sector a negative NFCA. This matters for several reasons. One is that the government would not be expected to cover private sector liabilities, so that netting the asset positions of all the sectors together may mask the real exposures of the private sector – although recent crises have highlighted the important role the government can play in providing implicit or explicit guarantees. From this perspective, consolidating private debts with large forex reserves at the country level could be highly misleading. Another factor is that the creditworthiness of the private sector will depend on its own currency exposures, not just of the country-wide situation. Yet a last factor is that specific market dynamics can be shaped by the private sector's reaction to an external shock; for instance, companies with large dollar debts will buy dollars to cover themselves when they think the dollar will appreciate – thereby putting downward pressure on the local currency, with the risk of creating a vicious circle of currency depreciation.

The third caveat is the difficulty to *capture off balance sheet positions and the related hedging of FC exposures*. The mismatch indicators presented here rely on a number of simplified assumptions (cf Box 2) which can lead to important shortcomings as discussed in Section 7 below. Nevertheless, even if the indicators cannot identify the extent to which the mismatch position has been hedged, this information can be useful for assessing vulnerabilities (CGFS (2007b)).[10]

[9] The impact on the country's total net financial worth (ie not just the NFCA that considers only the foreign currency debt instruments) is complex as it depends on the relative currency composition of all external assets and liabilities. Moreover, it is generally acknowledged that the related valuation effects have grown in importance with financial globalisation and the expansion of cross-border portfolio allocation (Lane and Shambaugh (2010)). A well-known example is the US international position and the role of valuation effects related to exchange rate movements due to the idiosyncratic role played by the dollar. US assets are denominated in several currencies (not least because these assets comprise a significant amount of US direct investment in foreign countries), while the vast majority of US liabilities are denominated in dollars, reflecting the primary role played by the dollar in international markets as well as the safe haven status of the US economy. As a result, when the dollar weakens vis-a-vis other major currencies, the value in dollars of US assets goes up, and the US IIP position improves, everything else being equal (Heath (2007)). This net effect should increase relative to GDP in parallel with the rise in the stocks of assets and liabilities associated with financial globalisation.

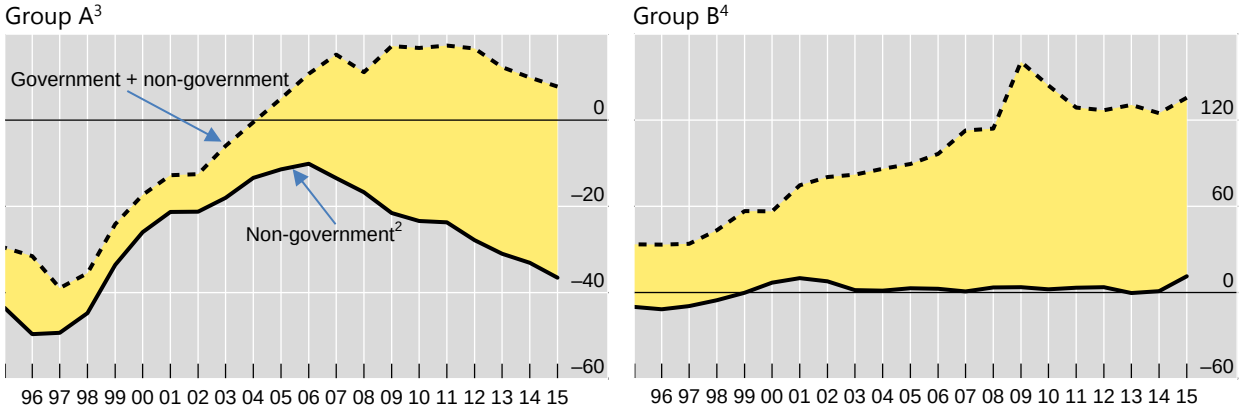
[10] For instance, the detection of large potential mismatches can be useful for monitoring whether and how hedging does in fact take place. Moreover, financial hedging can be costly, esp. for EME SMEs, or imperfect, raising other types of fragility (see also Chui et al (2014)). In particular, Gagnon (2014) notes that a solution to a currency mismatch may be creating a maturity mismatch to the extent that the balance-sheet positions have typically a longer maturity than corresponding derivatives positions; this is particularly problematic since maturity mismatches are often more difficult to identify – for an analysis of the interactions between FX and maturity risks in banks' balance sheets and the role played by the short maturity of FX swaps used for hedging positions, see in particular McGuire and von Peter (2009). Furthermore, when a crisis occurs, the financial position of the providers of hedges may also be impaired. A last point to note is that Borio and Packer (2004) found that adding measures of hedging possibilities do not bring much information when looking at the power of currency mismatch indicators for explaining sovereign ratings.

4. Evolution of currency mismatches in EMEs before and after the GFC

In what follows, we shall focus on the developments in aggregate net foreign currency assets as a percentage of exports (ie the NFCA/X ratio in (3)), leaving aside the influence of the FC share of debt.[11] The evolution observed since the mid-1990s is summarised in the dotted line of Graph 1. For a number of very large countries (eg China, India, Korea and Russia), shown in Panel B, the aggregate NFCA position is very strong, largely because of large official foreign exchange reserves: it increased markedly in the 2000s, and has roughly stabilised since 2010 at 120% of exports. In contrast, the position for the medium-sized EMEs, shown in Panel A, is less strong: their aggregate NFCA/X has in fact fallen since 2010 (although it is still somewhat positive).

Net foreign currency assets as a percentage of exports[1]

In percentages — Graph 1



[1] For net foreign currency assets, outstanding positions at year-end. Calculated with aggregates of the economies listed in footnotes 3-4. [2] Excluding the central bank and general government assets/liabilities where these can be identified. [3] Brazil, Chile, Colombia, the Czech Republic, Hungary, Indonesia, Malaysia, Mexico, Peru, the Philippines, Poland, South Africa, Thailand and Turkey. [4] China, Chinese Taipei, India, Korea and Russia.

Source: M Chui, E Kuruc and P Turner (2016).

Another key feature is that the decline in EMEs' currency mismatches revealed by these aggregate measures in the past few decades – especially from the 1990s to the 2000s – reflects to a significant extent changes in the ***official sector***'s[12] currency

[11] The reason of the simplified approach followed here (ie to focus only on the NFCA/X ratio instead of the more complete AECM in equation (3)) is that as a first approximation FC%TD is a *stock* variable that will change only progressively over time even if the FC composition of new debt issuance (the *flows* variable) varies. See Chui et al (2016) for the comprehensive data on recent developments in FC%TD and thereby on the AECM ratio, which shows a (relative) stabilization of the FC share of total debt in most EMEs since the early 2000s at least.

[12] The official sector being defined here as the sum of the government sector and the central bank (which in the SNA belongs to the financial corporate sector).

exposures, due to two main developments. One is that governments have reduced their foreign currency liabilities by shifting from bond issuance in dollars to local issuance, almost entirely in domestic currency.[13] A second is that EMEs' central banks have accumulated large foreign exchange reserves. The net result is that many official sectors in emerging regions now have a large net foreign currency asset position – so that any depreciation in the domestic currency actually improves aggregate countries' balance sheets.

In contrast, and not least reflecting the improved credit standing of many EME governments, EME companies have found it easier to borrow abroad. Several BIS papers have been pointing out for some time that the scale of EME companies' foreign currency borrowing rose substantially in the past decade – the "second phase of global liquidity (Shin (2013)). Recent BIS statistical work has therefore attempted to decompose aggregate currency mismatch measures into official sector and non-official sector mismatches (Chui et al (2016)). One difficulty is that the international data sources that can be used for this purpose do not provide full official sector/private sector breakdowns.

Nevertheless, two big components can be identified for EMEs: the central bank's foreign exchange reserves and the international foreign currency bonds issued by the government. Moreover, information is also available on the sectoral breakdown for the foreign currency claims of non-bank residents reported in the BIS LBS (cf BIS (2013)). The result of these estimates is the non-government sub-component of the NFCA/X ratio as shown in the continuous line of Graph 1. In particular, the left panel shows that in most medium-sized EMEs FC debt liabilities far exceed FC assets for the non-government sector (which mainly consists of non-financial corporations). By end-2015, net foreign currency liabilities of these countries have risen to 37% of exports. This suggests that the destabilising impact of the FC exposures recorded in some EMEs could be much larger than what aggregate country numbers tend to show.

5. Assessing the impact of exchange rates movements

As analysed above, the private sector's FC exposure plays a key role in determining forex market reactions. In case of significant currency mismatches, the balance sheets of EME firms worsen when the currency depreciates. In that case, depreciation can have a contractionary effect, counterbalancing the "traditional" stimulative effect through net exports. Attention has in particular focused on how exchange rate shifts can affect macroeconomic outcomes through the so-called "risk-taking channel", which works through changes in balance sheets and financial risk-taking (Bruno and Shin (2015)). A depreciation tends to weaken the balance sheets of entities that have net foreign currency liabilities. This in turn can weigh on internal demand directly (eg corporate spending) as well as indirectly, with the worsening of credit conditions: negative balance sheet effects reduce local lenders' risk-taking capacity, curtailing the provision of credit to the domestic economy.

[13] See CGFS (2007a) and the statistics compiled afterwards by the BIS, available for central government debt securities markets on http://www.bis.org/statistics/c2.pdf (Table C2).

Long-run elasticity of GDP growth with respect to real effective (REER) and debt-weighted (DWER) exchange rates

Table 1

	EMEs			Advanced economies		
	Short-run	Long-run	Ratio: short-run to long-run	Short-run	Long-run	Ratio: short-run to long-run
REER	–0.103***	–0.1217***	0.85	–0.058	–0.104***	0.56
DWER	0.1322***	0.105***	1.26	0.026	0.032	[1]
R-squared[2]		0.92			0.32	

***/**/* denotes results significant at the 1/5/10% level.

[1] Neither elasticity is statistically significant at 10%. [2] The higher R-squared for EMEs is a reflection of the higher explanatory power of the lagged dependent variable compared with advanced economies.

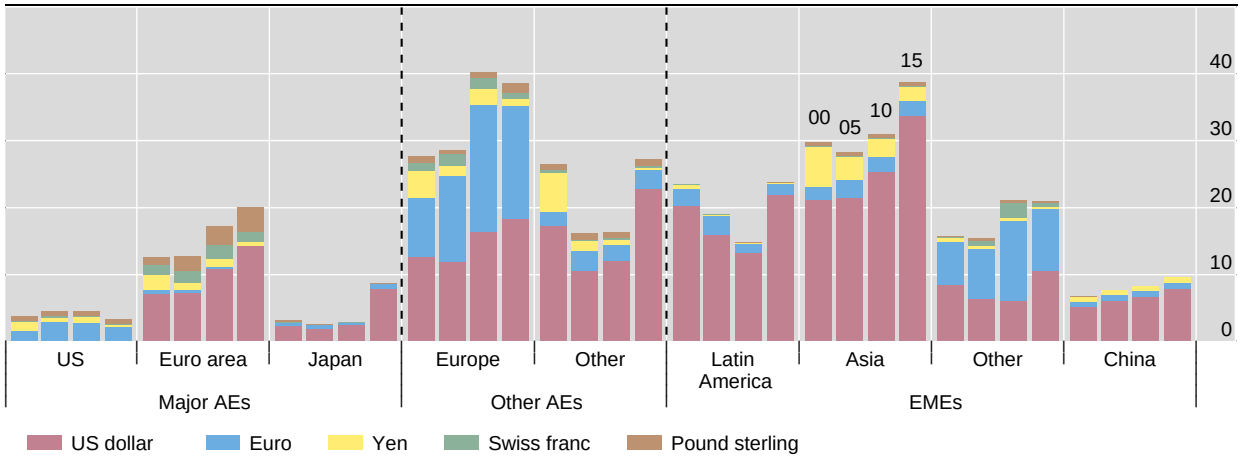
Source: BIS (2016).

Indeed, empirical evidence (BIS (2016)) tends to suggest the existence of a significant effect of exchange rate movements through the risk-taking channel for EMEs (while the effect is much smaller and not significant for advanced economies).[14] For the group of EMEs as a whole, BIS calculations indicate that the financial channel overshoots in the initial phase and has a larger short-run impact than the trade channel (whose effect builds with time). This implies that the contractionary effects of any currency depreciation via the financial channel dominate the expansionary effects of the trade channel in the short run; in the longer run, a depreciation seems to provide only a small boost to GDP (Table 1).

The US dollar is the dominant global funding currency[1]

Ratio of total foreign currency debt[2] to GDP for 2000, 2005, 2010 and 2015; in per cent

Graph 2



[1] Simple average across regions. End-of-year ratios. [2] Total foreign currency debt of non-bank residents of the respective economies.

Sources: BIS debt securities statistics and locational banking statistics; national data; BIS calculations (BIS (2016)).

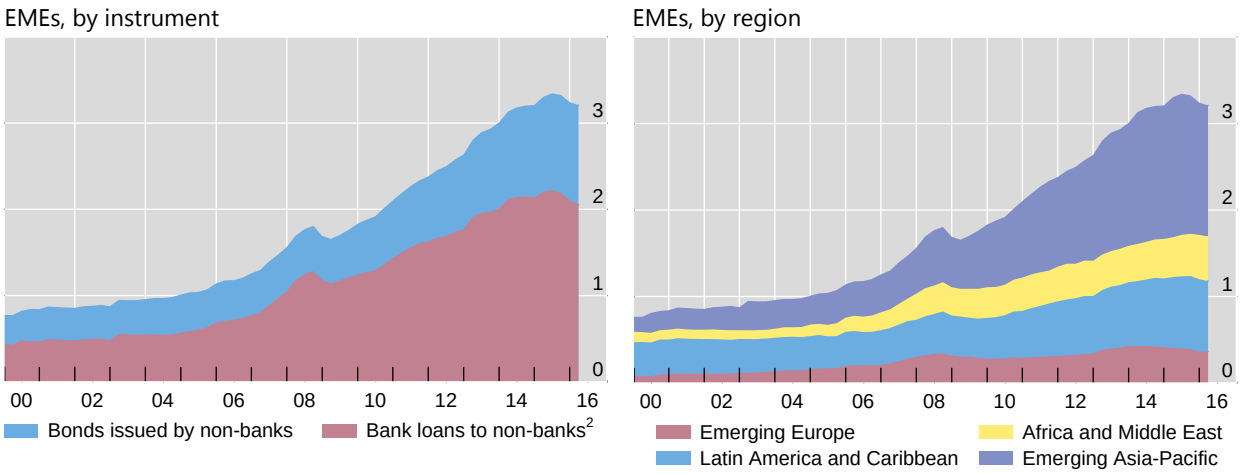
[14] An analysis confirmed by Kearns and Patel (2016), whose estimates try in addition to take into consideration country heterogeneity.

Moreover, much more of EMEs debt than EMEs trade is denominated in dollars. The dominant role of the US dollar as the global funding currency (Graph 2) implies that the possibility of contractionary depreciation can arise not only when the dollar appreciates relative to EMEs currencies, but also when it appreciates relative to the currencies of the major export markets of these EMEs, notably the euro (depending on the evolution of the related export prices).

These effects are likely to have increased in recent decades with the greater financial integration observed at the global level. For instance, the influence of a major international funding currency such as the dollar on global financial conditions, especially for EME borrowers, has been reflected in the substantial growth registered in the stock of US dollar-denominated debt of non-banks outside the United States (McCauley et al (2015)). Graph 3 shows its expansion to $9.7 trillion at end-2015, with $3.3 trillion of this to EMEs, a doubling since 2009.

US dollar-denominated credit to non-banks outside the United States[1]

Amounts outstanding, in trillions of US dollars — Graph 3



Further information on the BIS global liquidity indicators is available at www.bis.org/statistics/gli.htm.

[1] Non-banks comprise non-bank financial entities, non-financial corporations, governments, households and international organisations. [2] Loans by LBS-reporting banks to non-bank borrowers, including non-bank financial entities, comprise cross-border plus local loans. For countries that are not LBS-reporting countries, local loans in USD are estimated as follows: for China, local loans in foreign currencies are from national data and are assumed to be composed of 80% USD; for other non-reporting countries, local loans to non-banks are set equal to LBS-reporting banks' cross-border loans to banks in the country (denominated in USD), on the assumption that these funds are onlent to non-banks.

Sources: Datastream; BIS debt securities statistics and locational banking statistics (LBS).

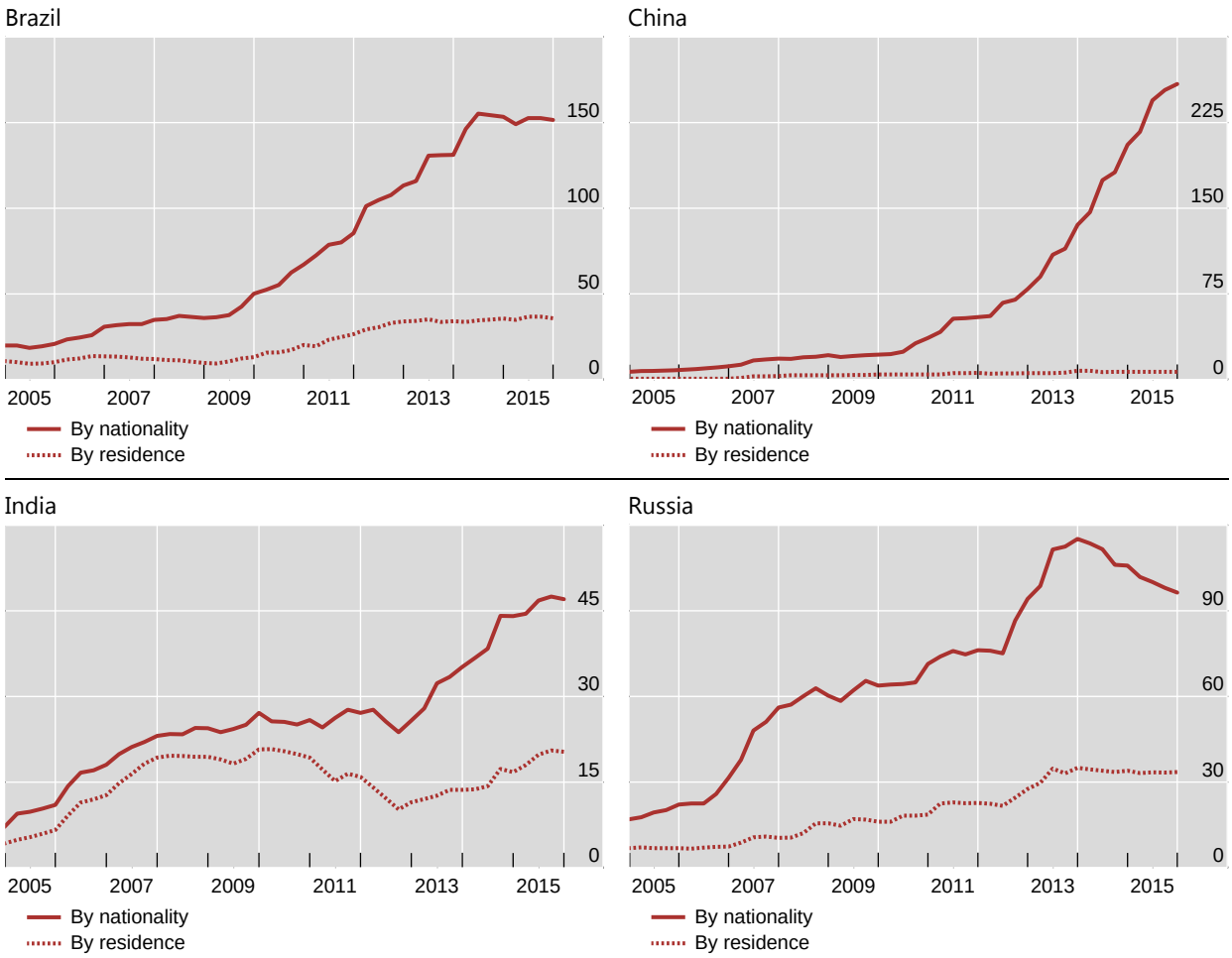
6. The limitations posed by the residency-based view of economic activity

The story does not end here. The international bond statistics used in the Goldstein and Turner measures of currency mismatches were compiled on a residency basis – that is, issuance by entities located in the country. Since 2010, however, local EMEs corporations have increasingly relied on bond issuance by their overseas subsidiaries – including financing vehicles established in financial centres offshore. Such issuance

can be better captured by statistics based on the nationality of the issuer (Gruić and Wooldridge (2015)). Nationality-based measures are better measures of the true risk exposures of corporate borrowers. It is the consolidated balance sheet of an international firm that can better capture its vulnerabilities, and that determines how the firm will react to macroeconomic or financial shocks (Tissot (2016a)).

International debt securities issued by non-financial companies outstanding in foreign currencies, by residency and by nationality[1]

Outstanding amounts, in billions of US dollars — Graph 4



[1] Issuer sector is immediate borrower basis by residence and ultimate borrower basis by nationality.

Sources: BIS international debt securities statistics.

Graph 4 shows how the gap between the debt issued on a residency and on a nationality basis has widened in recent years. The difference between international bonds outstanding in foreign currency on a residency basis and that on a nationality basis is largest for China ($260 billion on a nationality basis compared with $7 billion on a residency basis at end-2014), Brazil ($150 billion compared with $36 billion), India ($47 billion compared with $20 billion) and Russia ($96 billion compared with $34 billion).

Should the mismatch measure described above be adapted by replacing international bond issuance on a residency basis by that on a nationality basis? The answer is "perhaps, but not necessarily".

On the one hand, if a group has a foreign affiliate designed as purely a financing vehicle (motivated by tax, regulatory or jurisdictional considerations), such an affiliate would not generate new foreign currency sales. That is, the FC exposure of this affiliate would be high – it has foreign currency debts but is not generating additional foreign currency earnings. In such a case, the measures reported here would *understate* the true size of currency mismatches ultimately covered by the parent company. As argued by Avdjiev et al (2016), the "triple coincidence" of GDP area, decision-making unit and currency area can thus be highly misleading when assessing financial vulnerabilities.

On the other hand, EMEs' overseas affiliates may have their own productive capacity and can therefore generate revenues in foreign currencies. But the currency mismatch indicators presented above take into consideration a residency-based foreign trade measure, ie exports, which does not include the sales of foreign affiliates in the SNA framework. In that case, the indicators would overstate the mismatches, all else equal.

But one additional complication is that the residency-based measures of a country's exports also include the exports of the affiliates of foreign companies that are located in the country. These export revenues are therefore taken into consideration (with a positive impact) when constructing the country mismatch indicators presented above, while they may in fact lead to understate the true exposures of the domestic corporates of this country. All in all, the above factors suggest that it would be worth to compile complementary measures of currency mismatches, based on a residency and a nationality basis, to have a more complete picture.

7. The need for more granular information

Given the limitations analysed above, drawing a correct assessment of currency risk exposures would require mobilising more granular, microeconomic data on the balance sheets of specific companies. This calls for information at the consolidated group-level (eg nationality-based information). Indeed, after the GFC public authorities realised the need to enhance the availability of financial statistics to specifically address these issues (Borio (2013)). In particular, the International Monetary Fund (IMF) and the Financial Stability Board (FSB) launched in 2009 a Data Gaps Initiative (DGI-I) endorsed by the G-20 which comprised a recommendation to recognise the data deficiencies related to cross-border exposures. These included, for instance, the implicit guarantees provided by resident corporates to offshore entities set up to raise finance abroad, or the corporate exposures to exchange rate derivative products booked outside domestic jurisdictions (IMF and FSB (2009)).[15]

[15] Specifically, the DGI Recommendation #13 asked for a "*more comprehensive approach (… to…) identify such cross-border exposures*" and to "*address the methodological and practical issues of handling the concept of consolidation and the definition of corporate groups*". The organisations members of the

The second phase of the DGI (DGI-II) launched in 2016 in order to implement "*the regular collection and dissemination of comparable, timely, integrated, high quality, and standardized statistics for policy use*" also includes a Recommendation #14 specifically targeted to cross-border exposures, with a focus on non-financial corporations (Heath and Goksu (2016)). International organisations are invited to improve the consistency and dissemination of data on non-bank corporations' cross-border exposures, including those through foreign affiliates and intra-group funding, in order to better analyse the risks and vulnerabilities arising from such exposures including foreign currency mismatches. This work should draw on existing data collections by the BIS (which are precisely the sources mobilised for constructing the indicators presented above) and the IMF, and on the development of the OECD framework for Foreign Direct Investment (FDI). The development of an improved "infrastructure" for consolidating granular data for corporate positions and related exposures was in addition recommended (IMF and FSB (2015)).

Even with such international initiatives underway, however, it will be some time before comprehensive currency mismatch indicators can be made available. In the meantime, there is also room for better mobilising available micro data that provide information on corporate balance sheets.

Indeed, aggregate information can be usefully complemented by data drawn from financial statements, which are already publicly disclosed and available for listed corporates from commercial sources. Of particular interest are the databases combining funding information with firm-level financial data, for which one can derive leverage metrics and indicators of currency mismatch and funding risks (cf Graph 5 derived from Chui et al (2014)). Yet corporate-level accounting data raise significant issues not least in terms of international consistency as well as the difficulty to report information on currency exposures especially through hedging – noting that the reporting of hedging practices and uses of derivatives has still to be more standardised across accounting standards eg GAAPs/IFRS, and that complex accounting rules may lead to limited disclosure, esp. by (middle-sized) non-financial corporations (for a discussion of these issues, see Inter-Agency Group on Economic and Financial Statistics (2015)).

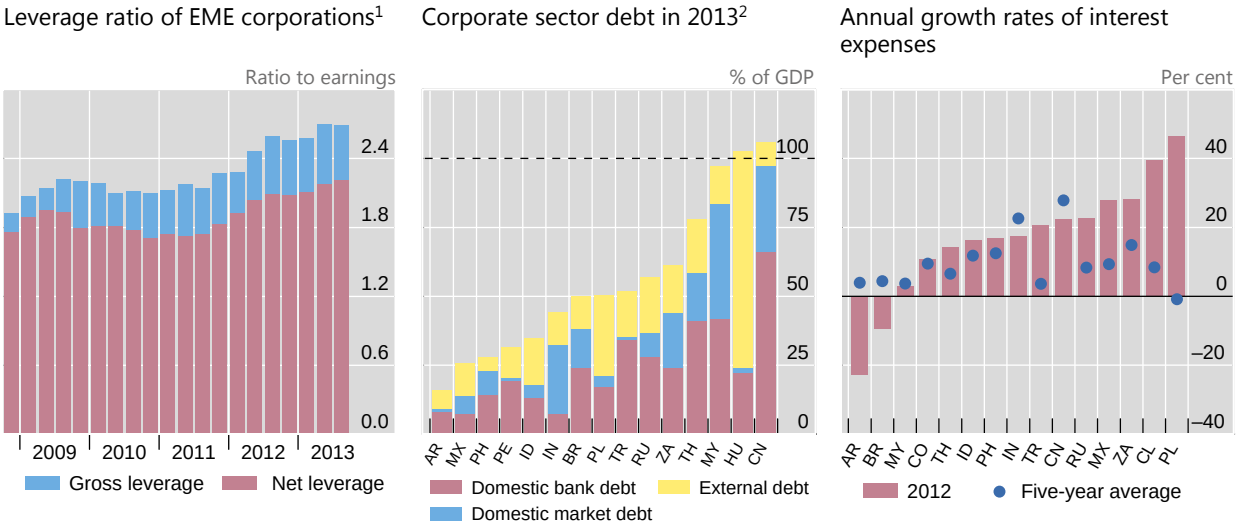
Moreover, corporate-level information is less available for non-listed companies, although they arguably represent only a smaller part of cross-border business and FX funding activities in EMEs. Certainly, other sources of granular balance sheet information (eg supervisory dataset) can be mobilised – cf Hulagu and Yalcin (2016), for a large panel of Turkish exporters, as well as IFC (2016a) and Tissot (2016b) more generally. As highlighted during the September 2016 IFC-ECCBSO-CBRT Conference on the *Uses of Central Balance Sheet Data Offices' information*, one could also develop and make use of the data collected by central balance sheet offices and credit registers. Other potential sources of useful micro information comprise derivatives exchanges, dealers networks and clearing houses providing registry services (eg to assess customers' derivatives exposures). The international community is indeed increasing its efforts to make a better use of the data collected by Trade Repositories and Central Clearing Counterparties in the aftermath of the Great Financial Crisis. Lastly, some ad hoc surveys can be helpful, such as the one organised by the Reserve

Inter-Agency Group on Economic and Financial Statistics (IAG) were thus invited to "*investigate the issue of monitoring and measuring cross-border, including foreign exchange derivative, exposures of nonfinancial, and financial, corporations with the intention of promoting reporting guidance and the dissemination of data*".

Bank of Australia on FX exposures and derivatives positions to monitor country's external position and banks' FX hedging (Rush et al (2013)). Such domestic surveys may be useful in particular to assess the respective role of natural hedges provided by FX revenues and financial hedging, as well as to identify specific patterns and exposures (eg unhedged currency funding such as carry trades; complex funding sources, structures and/or instruments; particular derivatives hedging techniques and counterparties).

Using financial statements to compute firm-level metrics[16] Graph 5

EME corporate balance sheets: selected metrics



AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; HU = Hungary; ID = Indonesia; IN = India; MX = Mexico; MY = Malaysia; PE = Peru; PH = Philippines; PL = Poland; RU =Russia; TH = Thailand; TR = Turkey; ZA = South Africa.

[1] Firm-level data from S&P Capital IQ for 900 companies in seven EMEs; simple average across countries; gross leverage = total debt/earnings; net leverage = (total debt – cash)/earnings. [2] External debt includes liabilities from affiliates, direct investments and other sources.

Sources: IMF, *Global Financial Stability Report*, April 2014; Morgan Stanley; BIS calculations.

Such data may not be sufficient to capture derivatives activity at the global, consolidated group level (ie with non-resident counterparties) as well as the full range of (untested) guarantees between the parent company and its offshore subsidiaries. Legal and confidentiality issues also constrain the wider use of such information. From this perspective, there is a need for promoting more (granular) data-sharing especially between national authorities. This was highlighted in the IFC Report on data-sharing (IFC (2015)) and is in line with the #20 recommendation of the second phase of the DGI that calls for the "*Promotion of Data Sharing by G-20 economies*". However, a recent survey of central banks shows that external sharing of micro data between central banks and other authorities remains limited (IFC (2016b)).

[16] Derived from Chui et al (2014).

8. Conclusion

The BIS's international banking and financial statistics can be very useful for assessing currency exposures, which is a key issue for EMEs. They allow computing summary indicators of currency mismatches, for the economy as a whole as well as for specific sectors.

These indicators show a significant decline in aggregate currency mismatches from the late 1990s to around 2010. But this reflected a reduction in the official sector's foreign currency exposures. Currency mismatches of EME corporates have increased in many medium-sized EMEs. The balance sheets of entities with net foreign currency liabilities would weaken significantly following currency depreciation. This can constrain corporate investment and so weigh on EMEs economic performance.

In addition, EMEs corporations have increasingly relied on bond issuance by their overseas subsidiaries, implying that residency-based indicators probably understate the true size of their fragilities. Addressing these issues in order to improve the assessment of currency risk exposures could benefit from accessing more granular, microeconomic data on corporates' balance sheets. Fortunately, a number of international statistical initiatives have been launched that should facilitate this endeavour.

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