SPILLOVER

NOTES

SPILLOVERS FROM

Dollar Appreciation

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Introduction

The recent strong and sustained appreciation of the U.S. dollar (USD) raises questions about possible financial spillovers to emerging markets (EMs). The global economy is steering away from the Great Recession, but the recovery is still uneven, with marked divergences in the pace of growth among major economies. Specifically, the U.S. economy has gathered strength, suggesting a normalization of Federal Reserve monetary policy in the next few months. In contrast, growth in the euro area and Japan is still subdued, and their monetary policies are easing further. Reflecting these divergences in the outlook and expected monetary policies, the USD has appreciated considerably against most major currencies, especially the euro and the yen, over the past year. The USD has also strengthened vis-à-vis most emerging market currencies, particularly those of commodity-exporting economies. Historically, periods of sharp USD appreciation have been associated with an increased number of external crises in emerging markets—hence a key concern relates to possible spillovers from a sustained period of USD appreciation on the financial stability of EMs, specifically through effects on global capital flows, exchange rates, and EMs' balance-sheet exposures. The focus of this paper is on the financial stability risks of a sustained USD appreciation and abstracts from general equilibrium effects from a USD appreciation, including through trade and EM policy responses.[1]

The paper is structured in three parts. First, it examines past episodes of prolonged USD appreciation, and in particular the 1995–2001 episode which is more similar in nature to the current one. It examines whether there are some general patterns in exchange rates, capital flows, cost of borrowing among EMs, and how consequences across EMs may have depended on EMs' structural characteristics (peggers versus non-peggers; fuel exporters versus others). The second section examines balance sheet risks at the country level, drawing on data on countries' international investment positions and the Bénétrix, Lane, and Shambaugh (2015) database on international currency exposures. It documents the evolution of EMs' external balance sheets and foreign currency exposures, and assesses to the extent possible the likely extent of currency-induced valuation effects so far. Aggregate data, however, may mask vulnerabilities within countries. In particular, the corporate debt of EMs has risen significantly in the past decade, justifying a closer examination of the nonfinancial corporate sector debt in the third section. Drawing on estimates of aggregate corporate sector foreign currency (FX) exposures and firm-level data on debt, earnings, and interest expenses, the last section examines corporate sector exposures and conducts a stress test involving an exchange rate shock combined with shocks to firms' earnings and borrowing costs to assess the share of firms (or debt) at risk in an adverse scenario.

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[1] From a general equilibrium perspective, an appreciation of the USD that is driven by stronger U.S. economic prospects—as is currently the case—may well have a net positive growth impact on its trading partners (through the external demand effect). And this effect would be stronger for exporters (to the United States) that experience a depreciation of their currency vis-à-vis the USD or in real effective terms more generally.

The main findings can be summarized as follows. Past episodes of sustained USD appreciation were associated with a rise in EMs' external crises, which reflected large foreign currency debt liabilities and sharp exchange rate depreciations for many EMs. This time around, many emerging market and developing economies (EMDEs) appear to be less vulnerable as their net foreign asset position has improved substantially and become less vulnerable to FX changes. Nevertheless, potential vulnerabilities to a USD appreciation remain. In particular, some countries in emerging Europe and the Commonwealth of Independent States (CIS) still have considerable short positions in USD debt instruments, and despite improving net positions, gross positions remain large in some countries. This is important because the holders of foreign liabilities may not be the holders of foreign assets. Large gross positions make countries more vulnerable to rollover and interest rate risks in case of sudden stops of capital inflows or drying up of FX market liquidity. At the corporate level, corporate debt-to-GDP ratios have increased to high levels in many countries, and highly leveraged corporate sectors also tend to have higher FX exposure. Higher debt loads and lower debt-servicing capacity increase the corporate sector's sensitivity to macroeconomic and financial shocks. A combination of severe shocks to interest rate, earnings, and (to a lesser extent) exchange rates could increase significantly debt at risk, in particular in countries where interest coverage ratios (ICRs) are already weak, in some cases overwhelming banks' buffers. Limiting further buildup of leverage and strengthening banks' buffers is important for all going forward.

1 Event Analysis: Evolution of Exchange Rates and Macroeconomic Conditions

Past episodes of strong and sustained USD appreciation were associated with a rise in EM external crises. Looking at the USD real effective exchange rate movements from 1980, one can identify three historical episodes of strong and sustained USD appreciation: 1980–85 (Pre-Plaza Accord), 1995–2001, and 2008–09 (Global Financial Crisis). The current appreciation episode started in August 2011 (when the USD real effective exchange rate bottomed out); however, much of the USD appreciation has taken place since July 2014. In all episodes, movements in the USD real effective exchange rate largely reflected a strengthening relative to other major advanced economy (AE) currencies and were large, amounting respectively to 37 percent, 29 percent, and 11 percent in the past three episodes; in comparison, the USD has appreciated so far by some 12 percent in real effective terms in the current episode. These episodes of strong and sustained USD appreciation were associated with a heightened number of external crises in EM economies (although less so in the Global Financial Crisis when the USD appreciation was more quickly reversed and where EM crises were in any case related to other factors) (Figure 1).

Figure 1. United States: Real Exchange Rates
(Index, 2010 = 100)

Sources: Catão and Milesi-Ferretti (2014); Federal Reserve Board of Governors; IMF, Information Notice System, International Financial Statistics, and Global Data Source databases; and IMF staff calculations.
Note: Higher number implies USD appreciation; REER = real effective exchange rate.
[1] Emerging market external crises include external defaults and rescheduling events, as well as the recourse to sizable multilateral financial support (IMF programs), as per Catão and Milesi-Ferretti (2014).

This raises the question of whether history could repeat itself in the current episode of USD appreciation. In what follows, we focus our comparison on the 1995–2001 episode, which appears most similar to current circumstances: the USD appreciation in both episodes is taking place against a background of stronger growth prospects and tighter monetary policy in the United States relative to Europe and Japan (Figure 2).[2]

Figure 2. Underlying Forces for Exchange Rate Movements

1. **Real Growth Rate Differential: 1995** [1]
   (Percent)
   — US vs. EA, 1995:Q3   ---- US vs. JPN, 1995:Q3

2. **Real Policy Rate Differential: 1995** [1,2]
   (Percent)
   — US vs. EA, 1995:Q3   ---- US vs. JPN, 1995:Q3

3. **Real Growth Rate Differential: 2011**
   (Percent)
   — US vs. EA, 2011:Q4   — US vs. JPN, 2011:Q4

4. **Real Policy Rate Differential: 2011**
   (Percent)
   — US vs. EA, 2011:Q4   — US vs. JPN, 2011:Q4

Sources: Haver Analytics; IMF, Global Data Source and World Economic Outlook; and IMF staff calculations.
[1] Positive number implies U.S. rate is higher than comparator rates.
[2] Real rate is based on 1-year ahead expected consumer price index inflation.

In both the 1995 and current episodes, EMDEs depreciated substantially relative to the USD in real and nominal terms—although patterns in real effective terms are much more varied. Figure 3 shows peak-to-trough depreciation rates for analytical groups of countries: in the 1995 episode, AE currencies depreciated in real terms vis-à-vis USD by 44 percent while EMDE currencies depreciated by 20 percent.[3] In real effective terms, the GDP-weighted average of EMDE currencies

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[2] In contrast, the 1980–85 appreciation episode was driven by a tightening of monetary policy aimed at fighting inflation and by increasing fiscal deficits. In the Global Financial Crisis, the strengthening of the USD had more to do with capital flight to safety in a context of heightened risk aversion and was quickly reversed.

[3] AE versus EMDE classification follows IMF's *World Economic Outlook* Appendix. This note covers 139 EMDE sample countries, including 53 lower-income countries and 27 fuel exporters. AEs excludes the United States in this note, if it is not stated otherwise.

appreciated, partly reflecting the weaker euro and yen. However, this masks varying evolutions, with some large EMs (Argentina, Brazil, Indonesia, South Africa) depreciating significantly in real effective terms over the 1995–2001 episode, while others (such as China, Hungary, India, Mexico, Poland, Russia, Turkey) appreciated. Turning to nominal exchange rates, EMDE and fuel exporters experienced much higher nominal depreciation than AEs both bilaterally against USD and in effective terms, reflecting much higher inflation in those economies (Figure 3, panel 2). The current episode of USD appreciation, which started gradually in August 2011 and accelerated in the last year, looks relatively similar. A comparison between the 1995 and current episodes shows that current depreciation rates are broadly halfway through the magnitudes observed in the 1995 episode: AE currencies have depreciated by 23 percent in real terms vis-à-vis USD, while EMDE currencies have depreciated by 6 percent in real terms (Figure 3, panel 3). Among the latter, the currencies of fuel exporters with floating exchange rate regimes generally experienced large depreciations (Figure 3, panel 4).

Figure 3. Depreciation Rates for Analytical Groups of Countries

1. **RER and REER Depreciation**
   (Percent)

2. **NER and NEER Depreciation**
   (Percent)

3. **AE vs. EMDE Real Exchange Rate vis-à-vis USD**
   (Percent; deviations from t = 0)

4. **EMDE Fuel-exporter: Real Exchange Rate vis-à-vis USD**
   (Percent; deviations from t = 0)

Sources: IMF, Information Notice System, Global Data Source, and International Financial Statistics; and IMF staff calculations.
Note: Positive number implies local currency depreciation (cumulative depreciation rate during the episodes). X-axis represents the number of quarters (t = 1 at beginning of each episode). AE = advanced economy; EMDE = emerging market and developing economy; NEER = nominal effective exchange rate; NER = nominal exchange rate; REER = real effective exchange rate; RER = real exchange rate.
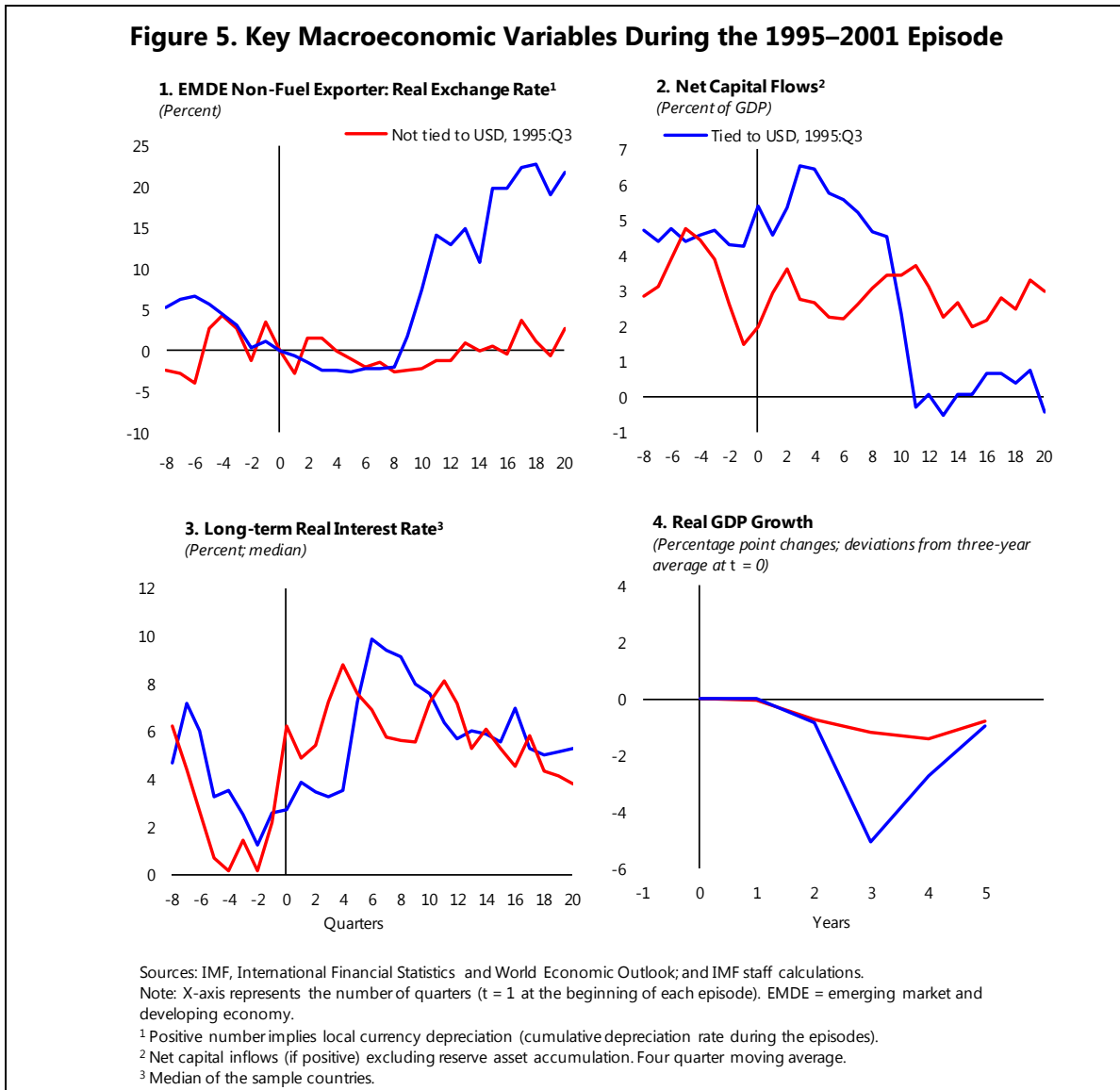
There was, however, substantial heterogeneity across EMs: countries with large foreign currency liabilities and limited exchange rate flexibility were more likely to experience an external crisis. An external crisis is defined to include external defaults and rescheduling events, as well as the recourse to sizable multilateral financial support (IMF programs), following Catão and Milesi-Ferretti (2014).[4] In the 1995–2001 episode (the focus of our comparison), crisis EM countries had worse initial conditions in 1995 than noncrisis countries, including more negative net FX assets, more negative net FX debt assets, and larger current account deficits (Figure 4). They also experienced large negative balance sheet effects (currency-induced valuation effect of net foreign assets, expressed as percent of GDP). Countries initially tied to the USD were also more likely to experience a crisis subsequently, in part reflecting the fact that the peg had facilitated a large buildup of FX exposure. For example, Figure 5 shows the evolution of key macroeconomic variables during the 1995–2001 episode for subgroups of non-fuel-exporting EMDEs according to currencies' flexibility vis-à-vis USD during the initial year of the episode. The focus is on non-fuel-exporting EMDEs to isolate effects from oil price fluctuations on capital flows and exchange rates. Non-fuel-exporting EMDEs were divided into "Tied to USD" group and "Not-tied to USD" group based on the following definition: a currency was defined as "Tied to USD" when it was classified as having a non-floating de facto exchange rate regime in IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (2014a) and Ghosh, Ostry, and Qureshi (2014), and had a limited variability in the nominal exchange rate vis-à-vis USD in the initial year of the episode. During the 1995 episode, the initial effect of USD appreciation was a rise in the real effective exchange rate of those countries tied to the USD (as in the run-up to the Asian crisis), but those real appreciation pressures ultimately gave rise to disorderly currency depreciation; thus the "tied" group experienced much more significant real depreciations relative to the USD than the "not-tied" group (Figure 5, panel 1).[5]

Figure 4. Initial Conditions of Crisis and Noncrisis Countries in 1995 Episode

EMs: Select Indicators at the Start of 1995 U.S. Dollar Appreciation Episode
(Percent of GDP; median values)

Sources: External Wealth of Nations database; Lane and Shambaugh (2010); IMF, World Economic Outlook database; and IMF staff calculations.
Note: FX = foreign currency.
[1] Currency-induced valuation effect of net foreign assets over episode, evaluated over 1995–2001.
[2] When 1995 value not available, earliest available value shown: China (1997) and Serbia (1998).
[3] Classification into crisis and noncrisis is based on Catão and Milesi-Ferretti (2014).

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[4] The list of EM crises in Catão and Milesi-Ferretti (2014) during 1995–2001 includes Argentina (1995, 2001), Mexico (1995), Jordan (1997), Thailand (1997), Indonesia (1998), Pakistan (1998), Ukraine (1998), Brazil (1999, 2001), Ecuador (1999), and Turkey (2000).
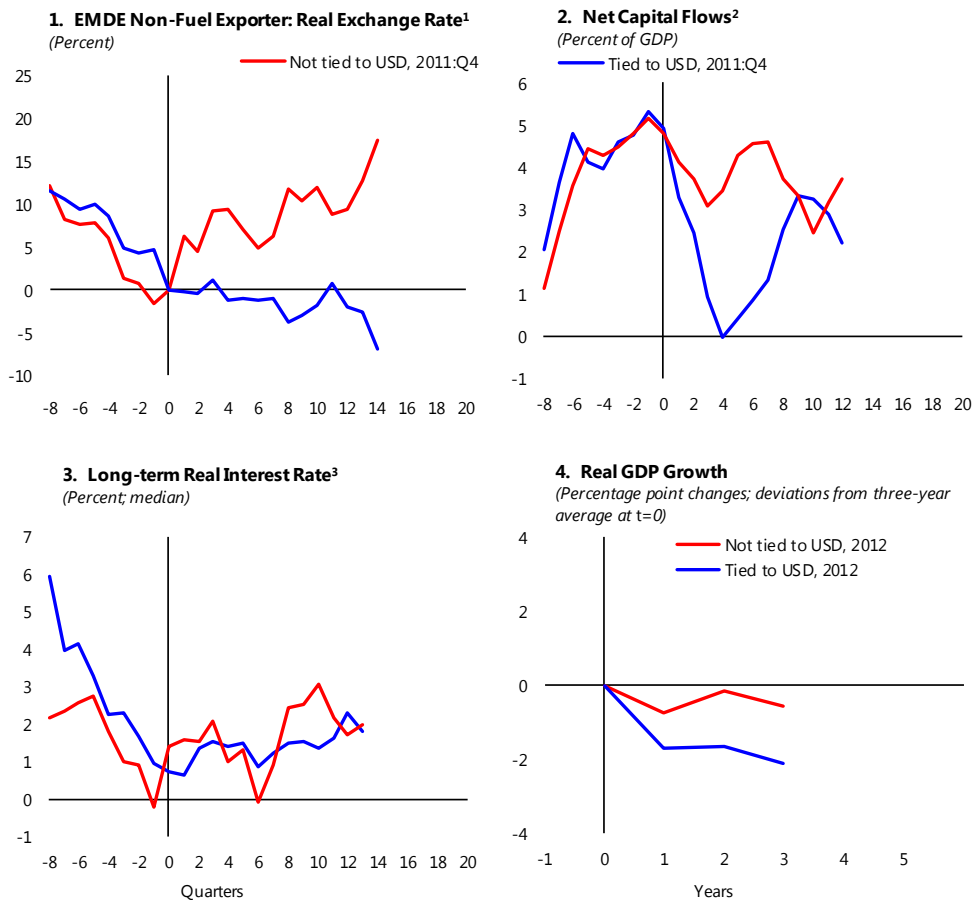
[5] Among the EM countries which experienced an external crisis during the 1995 episode, Argentina, Jordan, Thailand, Indonesia, and Brazil were classified as belonging to the "tied" group.

Figure 5. Key Macroeconomic Variables During the 1995–2001 Episode

1. EMDE Non-Fuel Exporter: Real Exchange Rate[1]
(Percent)

2. Net Capital Flows[2]
(Percent of GDP)

3. Long-term Real Interest Rate[3]
(Percent; median)

4. Real GDP Growth
(Percentage point changes; deviations from three-year average at t = 0)

Sources: IMF, International Financial Statistics and World Economic Outlook; and IMF staff calculations.
Note: X-axis represents the number of quarters (t = 1 at the beginning of each episode). EMDE = emerging market and developing economy.
[1] Positive number implies local currency depreciation (cumulative depreciation rate during the episodes).
[2] Net capital inflows (if positive) excluding reserve asset accumulation. Four quarter moving average.
[3] Median of the sample countries.

Ironically, the not-tied group did not significantly depreciate in real terms on average, albeit with significant nominal depreciation and very high inflation. Changes in capital flows were also more drastic in the initially tied-to-USD group. While their net inflows were initially larger than for non-tied currencies, the "tied" group experienced a sudden stop in net capital inflows, mainly driven by portfolio and other flows. This coincided with the currency crises, reserve asset losses, a spike in long-term interest rates, and a sharp adjustment in their current account deficit (Figure 5, panels 2 and 3). Meanwhile, currencies which were initially flexible were more immune to such sudden reversals of flows, although real long-term interest rates increased significantly; they experienced steadily increased net capital inflows and reserve asset accumulation during the episode. The external crises took a toll on output in the "tied" group, as domestic demand collapsed, while the improvement in the foreign balance provided only a mitigating effect (Figure 5, panel 4). In contrast, the not-tied group had on average more stable growth rates.

In the latest episode, there is so far no broad-based macroeconomic stress. First of all, major EM currencies' values have become more flexible with a few notable exceptions. For instance, Brazil, Thailand, Malaysia, the Philippines, and Peru which used to be classified as tied-to-USD in the 1995 episode, are not tied to USD in the current episode; the not-tied group is on average experiencing gradual depreciation in their real exchange rates vis-à-vis USD (Figure 6, panel 1). While the tied group is appreciating against the USD so far in this episode, the appreciations arguably reflect economies' performances instead of an external vulnerability buildup as in the 1995 episode, since the current tied group includes surplus economies such as China. Also, the nominal exchange rates, both bilateral vis-à-vis the USD and nominal effective rate, are not depreciating as much as in the 1995 episode, reflecting much more benign inflation in the current environment. The capital flow data also shows relative resilience in the current episode: while the EMDEs experienced decreased

Figure 6. Key Macroeconomic Variables During the 2011–2015 Episode

1. **EMDE Non-Fuel Exporter: Real Exchange Rate[1]**
(Percent)

2. **Net Capital Flows[2]**
(Percent of GDP)

3. **Long-term Real Interest Rate[3]**
(Percent; median)

4. **Real GDP Growth**
(Percentage point changes; deviations from three-year average at t=0)

Sources: IMF, International Financial Statistics and World Economic Outlook; and IMF staff calculations.
Note: X-axis represents the number of quarters (t = 1 at the beginning of each episode). EMDE = emerging market and developing economy.
[1] Positive number implies local currency depreciation (cumulative depreciation rate during the episodes).
[2] Net capital inflows (if positive) excluding reserve asset accumulation. Four quarter moving average.
[3] Median of the sample countries.

inflows (and reserve asset losses) at the onset of the current episode, capital flows rebounded sharply after the fourth quarter, albeit staying at more moderate levels than pre-USD appreciation (Figure 6, panel 2). Financing conditions measured by real long-term interest rates have also tightened but remain so far more benign than in the 1995 episode (Figure 6, panel 3). While real GDP growth has been gradually slowing in EMDEs, causality between USD appreciation and slowing EMDE growth would be difficult to ascertain in this case (Figure 6, panel 4).

The next section examines the evolution of external balance sheets in EMs to assess whether they remain a source of possible vulnerabilities in the current episode.
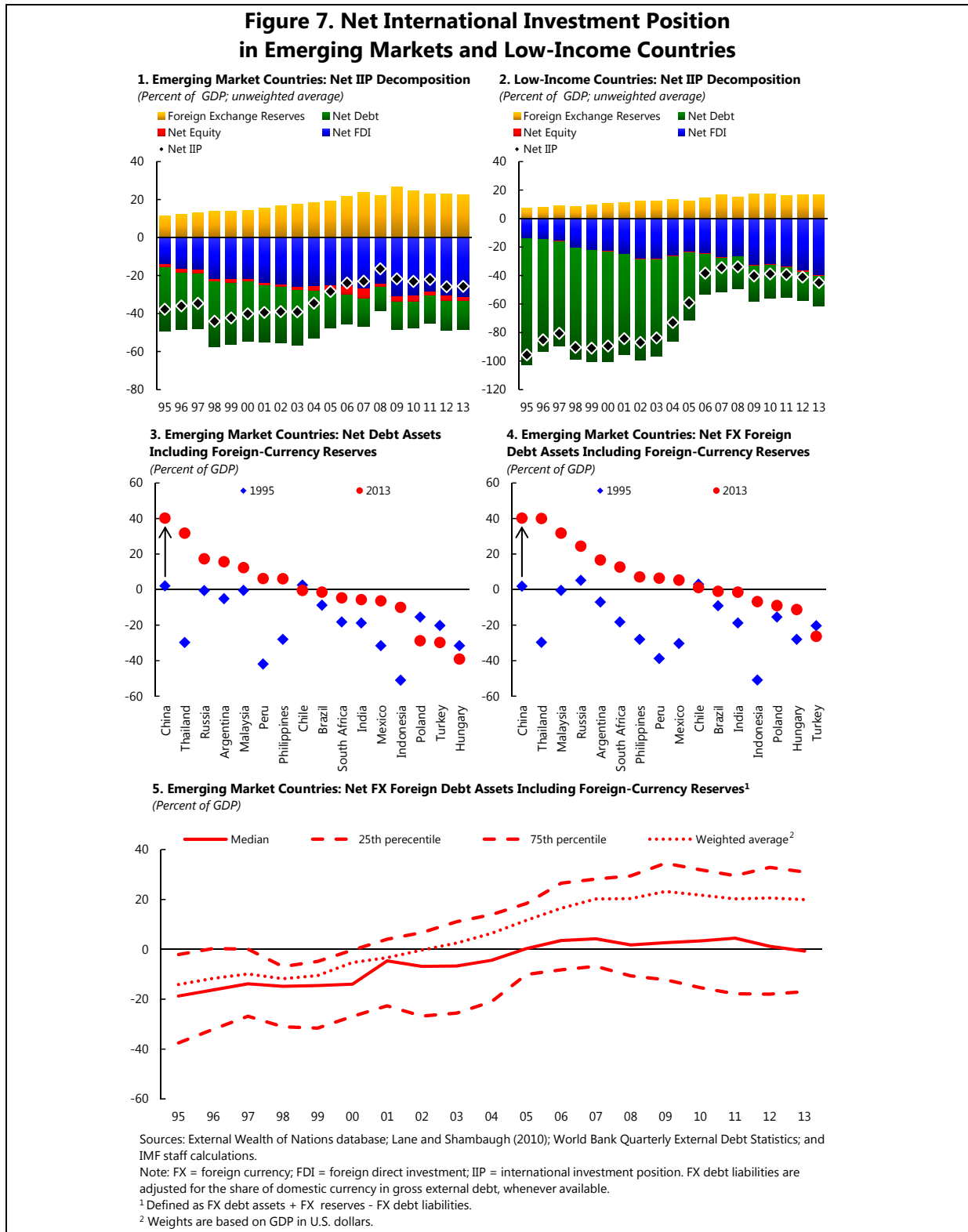
2 Country-level Balance Sheet Analysis

To analyze the evolution of balance sheets we combine a number of data sources:

- Lane and Milesi-Ferretti (2007) database on External Wealth of Nations, which shows the net international investment position (IIP), and its components (foreign direct investment, equity, debt, FX reserves). Foreign assets and liabilities are defined based on the residency concept underpinning balance of payments statistics. It therefore does not directly capture issuance of securities through offshore subsidiaries.

- Bénétrix, Lane, and Shambaugh's (2015) database on international currency exposures, which provides estimates of the currency composition of total foreign assets and liabilities, as well as foreign debt assets and liabilities. It should be noted from the outset that there are serious limitations to the currency composition data and that in any case these data do not take into account hedging through derivatives. One such limiting assumption in the database is that the domestic currency share of external debt liabilities is zero for EMDEs. This does not account for the fact that EMs have been increasingly able to issue domestic-currency external debt which helps reduce their vulnerability to exchange rate shocks. We correct the data for the share of domestic-currency debt in gross external debt when it is available in the World Bank Quarterly External Debt Database (IMF and World Bank, 2015) or from national sources for systemic EMs. While the Bénétrix, Lane, and Shambaugh database stops in 2012, we apply the 2012 currency weights to the 2013 data from the External Wealth of Nations to get exposures for 2013.

Since the mid-1990s, the net international investment position of EMDEs has improved considerably and has become less vulnerable to FX changes. These evolutions reflect three factors: (1) since the mid-1990s, EM current accounts have improved substantially, leading to stronger IIP and more FX reserve accumulation; (2) EMDEs have been able to rely increasingly on domestic currency, equity-type liabilities, reducing their dependency on FX debt; and (3) EMs have increasingly been able to issue in domestic currency debt instruments (Figure 7, panels 1–2). The net IIP of EMs increased on average from about −40 percent of GDP in 1995 to −25 percent of GDP in 2013, with net (external) debt improving by about 20 percentage points of GDP and FX reserves by about 10 percentage points of GDP. The improvement in net IIP and net debt is even more striking for low-income countries, partly reflecting debt forgiveness for highly indebted countries. Focusing on large EMs, net debt assets including FX reserves have improved significantly in most countries, but have worsened in Poland, Hungary, and Turkey where they remain substantially negative (Figure 7, panel 3).

As a result, many EMs, including the most systemic countries, are now long FX in debt instruments, a sharp improvement from the mid-1990s. As noted above, estimates of the currency composition of foreign assets and liabilities are subject to limitations. However, using the best

Figure 7. Net International Investment Position in Emerging Markets and Low-Income Countries

1. Emerging Market Countries: Net IIP Decomposition
(Percent of GDP; unweighted average)

2. Low-Income Countries: Net IIP Decomposition
(Percent of GDP; unweighted average)

3. Emerging Market Countries: Net Debt Assets Including Foreign-Currency Reserves
(Percent of GDP)

4. Emerging Market Countries: Net FX Foreign Debt Assets Including Foreign-Currency Reserves
(Percent of GDP)

5. Emerging Market Countries: Net FX Foreign Debt Assets Including Foreign-Currency Reserves[1]
(Percent of GDP)

Sources: External Wealth of Nations database; Lane and Shambaugh (2010); World Bank Quarterly External Debt Statistics; and IMF staff calculations.

Note: FX = foreign currency; FDI = foreign direct investment; IIP = international investment position. FX debt liabilities are adjusted for the share of domestic currency in gross external debt, whenever available.

[1] Defined as FX debt assets + FX reserves - FX debt liabilities.

[2] Weights are based on GDP in U.S. dollars.

information currently available, we calculate the net FX debt asset position, defined as the sum of FX debt assets and FX reserves, minus FX debt liabilities. While net debt assets include domestic currency debt held by nonresidents, net FX debt assets focuses only on foreign currency debt assets and liabilities. About half of EMs have a long FX debt position, and another quarter have a short FX debt position inferior to 20 percent of GDP (Figure 7, panel 5). Systemic EMs (with the exception of Turkey) have also considerably improved their net FX debt asset position. Most of them have become long FX, and fuel exporters and some EMs in emerging Asia have accumulated large long FX positions (Figure 7, panel 4). Nevertheless, it is also worth noting that since the mid-2000s, the short FX position of the bottom quartile of the country distribution has started widening again, indicating a gradual re-buildup of vulnerabilities (Figure 7, panel 5).

But while net positions may have improved, large gross positions in some countries still signal vulnerabilities. Looking at gross liabilities is also important because agents holding foreign assets may not be the same as those holding foreign liabilities. This is especially pointed given that foreign liabilities have increasingly migrated from sovereign to nonfinancial corporate balance sheets in some countries (see below). Therefore, balance sheet effects on the asset and liability side may not offset each other. Moreover, large gross positions make countries more vulnerable to rollover and interest rate risk in case of sudden stops of capital inflows and drying up of FX market liquidity. Foreign liabilities are especially large in Malaysia, Thailand, Chile, Poland, Hungary, and South Africa (Figure 8, panel 1). However, to the extent that foreign liabilities take the form of foreign direct investment, they may be less sensitive to rollover and interest rate risks. The next panel therefore also shows FX debt liabilities: these remain high in Chile, Hungary, Malaysia, Peru, the Philippines, Poland, and Turkey.[6] In most cases, they remain below the levels observed in Indonesia and Thailand before the Asian financial crisis (Figure 8, panel 3). Section 3 will examine vulnerabilities arising from gross debt liabilities of nonfinancial firms.
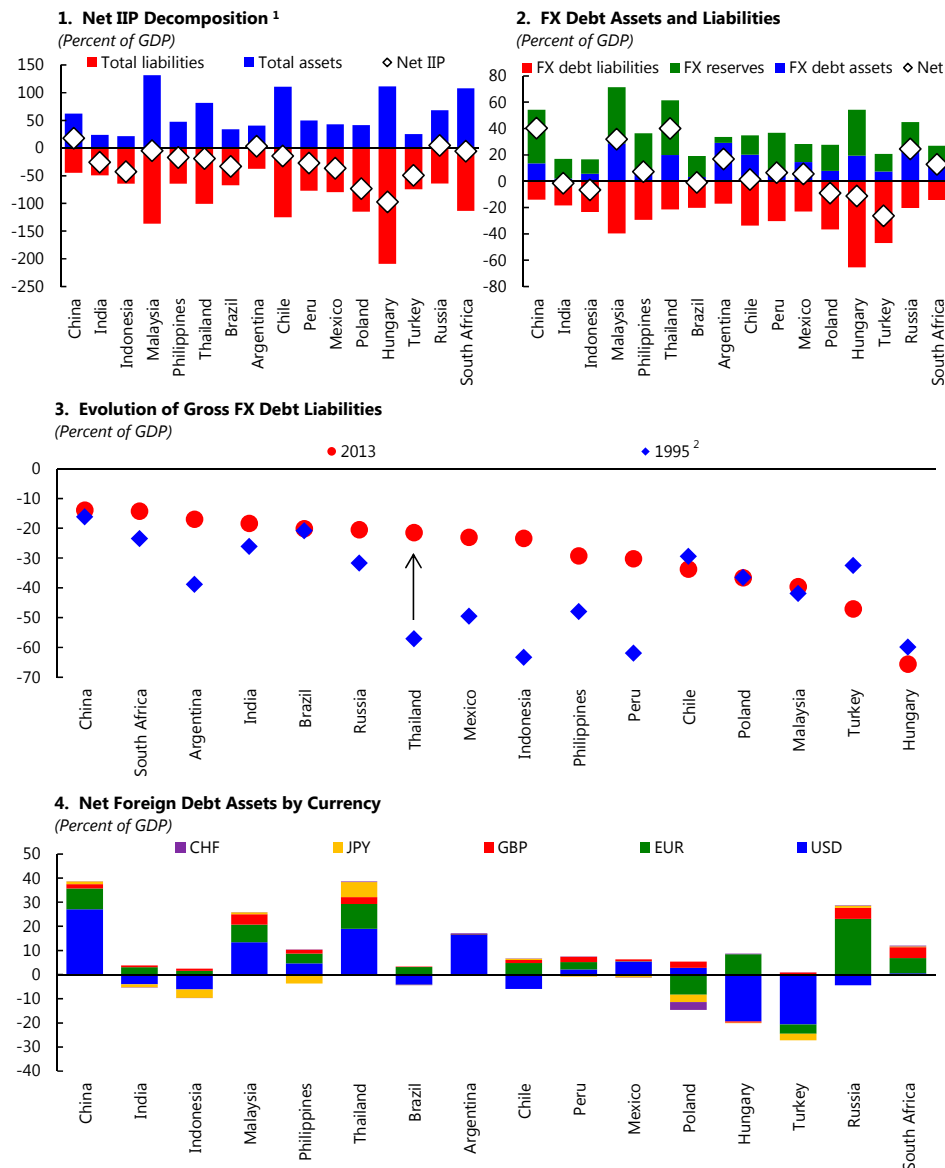
The currency composition of the FX debt position also matters to determine vulnerability to a USD appreciation. For most countries, debt liabilities are mostly in USD, except in emerging Europe where debt in euro is prevalent. Debt assets are both in USD and euro. Finally, the currency composition of FX reserves broadly aligns with that of FX debt: countries whose liabilities are exposed to the USD have a higher share of USD in reserves, while emerging Europe tends to have both higher euro debt liabilities and euro FX reserves. Focusing on systemic EMs, most have small net debt asset positions in both the USD and the euro (Figure 8, panel 4). Hungary and Turkey, however, have a large short debt position in USD, which may pose challenges in the face of a USD appreciation.[7] In contrast, China and Thailand have considerable long debt positions in USD and euro, and Russia in the euro, which could also expose them to balance sheet effects (either positive if they appreciate against the euro or negative in the contrary case). A number of nonsystemic economies, especially in CIS, also have large short USD debt positions.

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[6] In Poland, the large negative net international investment position is driven by significant inflows of foreign direct investment; moreover, a high share of relatively stable intercompany debt is a mitigating factor. According to the Bank Negara Malaysia, there are a number of mitigating factors in Malaysia, including deep-pocketed domestic investors and the encouragement of hedging by Bank Negara Malaysia.

[7] According to the Hungarian authorities, a lot of the dollar liabilities are hedged, including for the government.

To estimate balance sheet effects, we combine information on currency exposures and exchange rate movements. We focus here on a subset of balance sheet effects, in particular the one resulting from exchange rate changes; there could be additional balance sheet effects from the fluctuation of asset prices and interest rates. The balance sheet effect of FX shocks is calculated as the change in the ratio of net FX debt assets to GDP induced by currency changes. A movement in the exchange rate relative to a foreign currency will affect the domestic currency value of net debt

Figure 8. Net International Investment Position Decomposition, Foreign Exchange Debt Assets, and Liabilities for Select Emerging Markets

(2013)

1. Net IIP Decomposition [1]
(Percent of GDP)

2. FX Debt Assets and Liabilities
(Percent of GDP)

3. Evolution of Gross FX Debt Liabilities
(Percent of GDP)

4. Net Foreign Debt Assets by Currency
(Percent of GDP)

Sources: External Wealth of Nations database; Lane and Shambaugh (2010); World Bank Quarterly External Debt Statistics; and IMF staff calculations.

Note: FX = foreign currency; IIP = international investment position. FX debt liabilities are adjusted for the share of domestic currency in gross external debt, whenever available.

[1] For Hungary, special purpose vehicles have been excluded from foreign direct investment assets and liabilities.

[2] 1996 value shown for Russia as 1995 value not available.

assets denominated in that foreign currency (numerator of the ratio). The currency movement can also affect the domestic currency value of GDP (denominator of the ratio) through changes in the GDP deflator. While ideally we would like to isolate the effect of the various currencies' movements on the GDP deflator, this is beyond the scope of this paper; to simplify, we adjust GDP for the change in the GDP deflator over the period considered. This correction is important in the case of countries experiencing simultaneously large exchange rate depreciations and high inflation: failing to correct for the impact of inflation in the denominator would lead to overestimate the increase in the debt burden in domestic currency. We estimate balance sheet effects for debt assets and liabilities denominated in the five major currencies (USD, euro, yen, pound, and Swiss franc). These cover most FX debt liabilities and assets (with a few exceptions).[8] Balance sheet effects are calculated for the period from end-2013 until April 2015.[9] Thus, the calculations are:

$$X = \sum_i \frac{(A_i + R_i - L_i) \times (1 + \%\Delta XR_i)}{Y \times (1 + \%\Delta Y\ deflator)} - \frac{(A_i + R_i - L_i)}{Y}$$

where X denotes the balance sheet effect, i denotes the foreign currency, A_i denotes the domestic currency value of foreign debt assets denominated in currency i, R_i is the domestic currency value of FX reserves denominated in foreign currency i, L_i is the domestic currency value of foreign debt liabilities denominated in foreign currency i, Y is the domestic currency value of GDP, and XR_i is the bilateral nominal exchange rate relative to currency i (defined as domestic currency per unit of foreign currency).
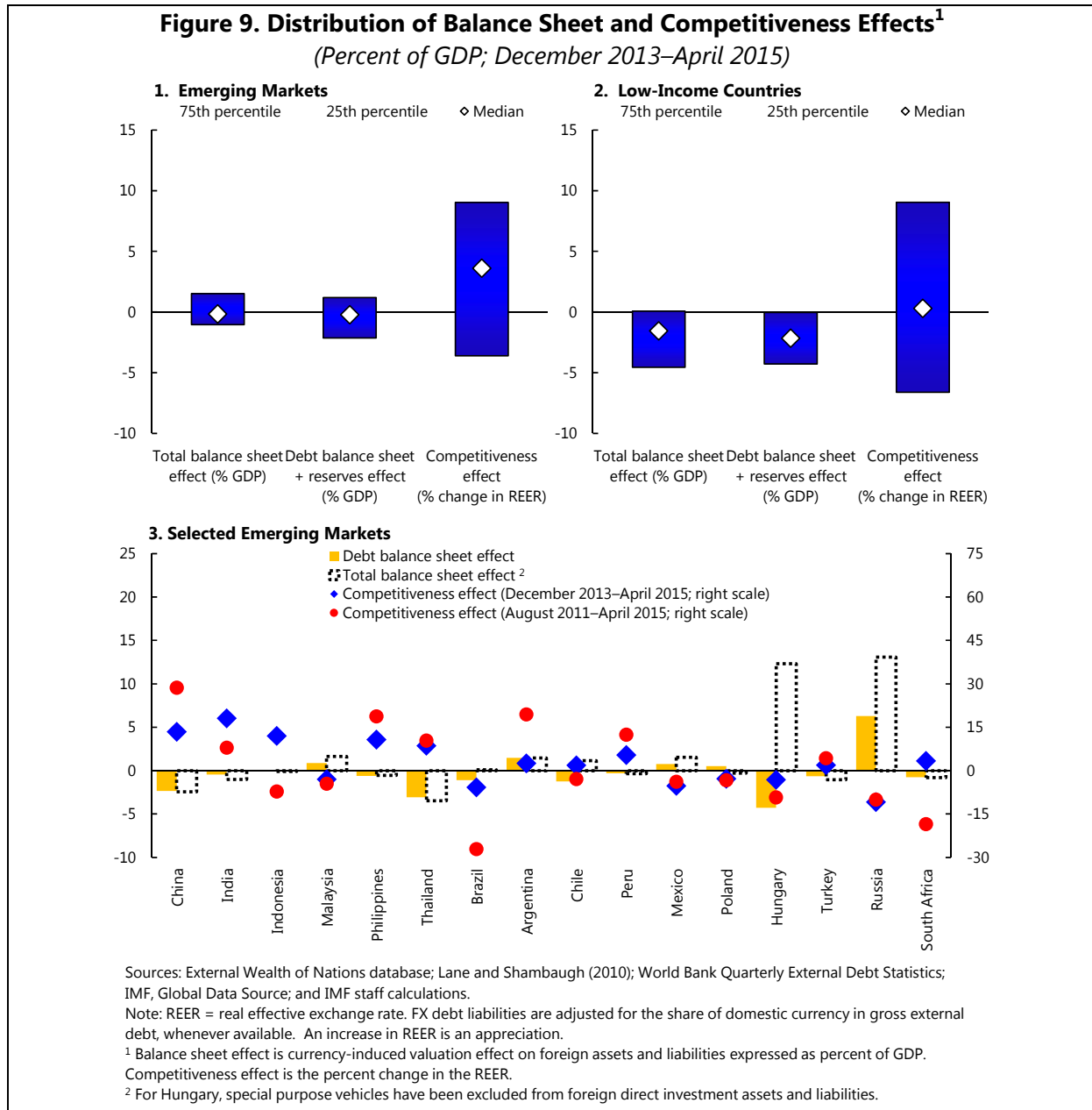
Our calculations indicate that *net* balance sheet effects appear to remain moderate so far in most cases, though vulnerabilities could arise from balance sheet mismatches and further USD appreciation. Despite significant nominal depreciations against the USD, and in some cases (emerging Europe, CIS) against the euro, estimates of net debt balance sheet effects are so far moderate for the majority of countries, especially when compared with valuation effects experienced by crisis countries during the mid-1990s appreciation episode (Figure 9, panels 1 to 3). Negative balance sheet effects are however larger in Hungary, and in some smaller countries especially from the CIS, reflecting large short USD debt positions combined with sizable depreciations against the USD.[10] China and Thailand also experienced negative balance sheet effects, due to an appreciation against the euro in which they have significant long positions. Russia had large positive balance sheet effects, reflecting its depreciation against the euro in which it has a large long debt position. Balance sheet effects for total net FX assets show a broadly similar picture, but are somewhat less reliable because a larger share of foreign assets (and in a few cases liabilities) are in other (undefined) currencies and cannot be included. However, balance sheet effects for total net FX assets are typically more positive because non-debt foreign assets are typically in FX while non-debt foreign liabilities

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[8] There is a significant fraction of debt assets in other currencies for Malaysia (21 percent) and China (12 percent).

[9] While the USD started to appreciate gradually in 2011, most of the USD appreciation in real effective terms took place after 2013. Moreover, debt repayments and contracting of new debt (at different exchange rates) are presumably small relative to the existing stock over a 15-month period, which simplifies the calculations.

[10] According to the Hungarian authorities, a lot of the dollar liabilities are hedged, including for the government.

are mostly in domestic currency. One important caveat to these net balance sheet effect calculations is that the holders of foreign liabilities may not be the holders of foreign assets, so that the aggregate number may mask larger balance sheet effects and vulnerabilities at a more disaggregated level. We make an attempt at examining this issue in the last section which focuses on debt liabilities of nonfinancial corporations.

Figure 9. Distribution of Balance Sheet and Competitiveness Effects[1]
(Percent of GDP; December 2013–April 2015)

Sources: External Wealth of Nations database; Lane and Shambaugh (2010); World Bank Quarterly External Debt Statistics; IMF, Global Data Source; and IMF staff calculations.
Note: REER = real effective exchange rate. FX debt liabilities are adjusted for the share of domestic currency in gross external debt, whenever available. An increase in REER is an appreciation.
[1] Balance sheet effect is currency-induced valuation effect on foreign assets and liabilities expressed as percent of GDP. Competitiveness effect is the percent change in the REER.
[2] For Hungary, special purpose vehicles have been excluded from foreign direct investment assets and liabilities.

Finally, balance sheet effects have to be weighed against competitiveness and trade effects of a USD appreciation. Despite nominal depreciations against the USD, most EMs have been experiencing an appreciation of their real effective exchange rate since December 2013, which on average is moderate so far (see Figure 9, panels 1 to 3). However, countries that are "tied" to some

extent to the USD have seen a stronger real effective appreciation, which over time could have repercussions over competitiveness, external balance, and growth. About one-third of EMDEs are tied to some extent to the USD, including many fuel exporters which are also affected by a deterioration of their terms of trade (oil price decline) and would have benefited from a depreciation of their currencies. Among systemic EMs, countries in emerging Asia, including China, have experienced an appreciation trend in real effective terms which in China has served to remove previous undervaluation. In contrast, countries more closely tied to the euro and for which the euro has a larger trade weight, for instance in emerging Europe, have experienced positive or only small negative price competitiveness effects. Brazil, Russia, and South Africa have experienced large depreciations, but with positive or small negative balance sheet effects, given their positive or small negative net debt asset positions. For those countries that have a large short debt position in USD, but trade a lot with the euro area (e.g., Hungary, Turkey), however, there is a clear potential trade-off between balance sheet and competitiveness effects.

While balance sheet risks have improved, there certainly remain serious vulnerabilities and much will depend on the magnitude of the USD appreciation and capital outflows.

- Even by our simple metric of net FX debt assets, exposure remains substantial for a significant fraction of countries, including in emerging Europe and the CIS.

- In addition, the holders of FX debt liabilities may not be the holders of FX reserves or other FX debt assets. Gross debt liabilities remain large in a number of countries, exposing their holders to larger balance sheet effects (if they do not hold FX assets), as well as to rollover and interest rate risk in case of sudden stop of capital inflows. Moreover, while large reserves do provide some reassurance to foreign investors, they may not prove enough if financial conditions become disorderly.

- While EMs have had increasing access to issuing domestic currency external debt which is not vulnerable to exchange rate changes, this type of debt is not itself without risk. While it avoids exchange rate-related balance sheet effects, it also introduces exchange rate risk for foreign investors and the risk of a sudden stop. Sudden capital outflows or a sharp rise in interest rates would have a substantial impact on EMs' domestic bond markets and financing costs.

- Finally, our measure of FX exposure is based on a residency concept and does not include issuances by offshore subsidiaries, which could be significant for a few larger EMs.

Further sharp and rapid appreciation of the USD could trigger more significant balance sheet effects, or raise pressures on FX reserves and lead to sharper deterioration of exports and growth in countries tied to the USD.

The next section looks at vulnerabilities in the nonfinancial corporate sector, where corporate borrowing has picked up considerably in recent years, including in foreign currencies.

3 Balance Sheet Risks in Emerging Market Firms

The corporate debt stock in EMs has risen significantly over the past decade, raising questions about potential vulnerabilities and spillovers. Both total and foreign currency corporate debt rose most rapidly in Asia and Latin America since the Global Financial Crisis against the backdrop of ample global liquidity and prolonged low global interest rates, while European corporations started deleveraging (Figure 10, panels 1 and 2).[11] Given the important linkages of the nonfinancial corporate sector to the rest of the economy, the sector's balance sheet condition has significant implications for the domestic and international banking system as well as the government sector, affecting banks' nonperforming loans, profitability, lending conditions, and governments' contingent liabilities. A key question that follows is how vulnerable EM corporate balance sheets are to shocks such as an economic slowdown, currency depreciation, and rising interest rates. Balance sheets tend to be vulnerable when leverage starts to loom too large relative to borrowers' debt servicing capacity, when FX revenues and assets are not sufficient to cover liabilities in FX, or when debt is maturing much earlier than the realization of asset returns and income streams.

We combine aggregate corporate sector data and firm-level data to assess corporate vulnerabilities. Aggregate corporate sector data are from the IMF's Vulnerability Exercise Securities database, while annual data on firm-level balance sheet information from 15 EMs across Asia (China, India, Indonesia, Malaysia, the Philippines, Thailand), Latin America (Argentina, Brazil, Chile, Mexico), and Europe, Middle East, and Africa (Bulgaria, Hungary, Poland, Russia, South Africa) are from Orbis. Orbis covers close to 40,000 firms in the sample countries that include public and private, large and small companies, though they vary between countries. The coverage of firms' total assets is around two-thirds of the total GDP of these sample countries (Table 1). As the breakdown of firm-by-firm foreign currency borrowing is not available through Orbis and other in-house databases, we make two assumptions:

Table 1. Coverage of Firms by Orbis

	Number of Firms	Total Assets (US$ billion)
Asia		
China	3,720	4,995
India	4,797	1,464
Indonesia	428	220
Malaysia	2,974	913
Thailand	4,921	527
Philippines	4,976	226
Latin America		
Argentina	155	83
Chile	366	481
Brazil	691	1,531
Mexico	116	716
Europe, Middle East, and Africa		
Russia	148	1,539
South africa	260	215
Poland	4,912	467
Hungary	4,988	305
Bulgaria	4,741	140

Source: Orbis.

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[11] New corporate bond issuance rose 32 percent in 2014, with Asia leading other regions. Issuance in foreign currency amounted to two-thirds of total issuance over the last five years, growing at a compounded annual rate of 21 percent during the period. Sectors such as industry, utilities, and energy accounted for three-quarters of the new debt in 2014. In Latin America and Europe, Middle East, and Africa, the energy sector comprised the largest share of issuance, while in Asia, the lion's share came from industries. Along with the rise in corporate bond issuance, borrowing from banks has also increased.

Figure 10. Emerging Market Corporate Debt Exposures

1. Nonfinancial Corporate Debt Outstanding
(Percent of GDP; unweighted average)

— World — Asia — Latin America — Europe

2. Nonfinancial Corporate Debt Outstanding in FX
(Percent of GDP)

— Average — Asia — Latin America — Europe

3. Corporate Debt to GDP
(Debt in percent of GDP)

■ Domestic market debt and bank loans
■ External debt in other currencies
■ External debt in EUR
■ External debt in USD

4. FX Breakdown of Total Income [1]
(Share of total income)

■ LCU ■ Others ■ USD ■ EUR

5. Gross Foreign-Currency and Dollar Leverage by Country, 2013

Size of bubble:
USD leverage = USD debt/USD EBITDA

FX leverage (median FX debt/FX EBITDA), 2013

Gross leverage (median debt/EBITDA), 2013

HUN
MEX
IDN
BGR
IND
CHL
ARG
POL MYS ZAF PHL RUS
THA CHN
BRA

Sources: Bank for International Settlements; Dealogic; IMF, Corporate Vulnerability Utility, Vulnerability Exercise Securities Database, Vulnerability Exercise for Emerging Markets, and International Financial Statistics; and IMF staff calculations.
Note: FX = foreign currency.
[1] FX share of total income is obtained from CVU, while currency breakdown is based on trade weights (e.g. United States and China in USD, and euro area in euro). This may underestimate the share of total income which is in USD or euro if trade with other countries is invoiced in these currencies.

- the firm-level share of foreign currency borrowing in corporate debt is approximated by the share of aggregate corporate external debt in total corporate debt from the Vulnerability Exercise Securities Database; and

- the currency breakdown of foreign currency borrowing is approximated by the share of USD and EUR bonds from Dealogic.

Data limitations should be acknowledged at the outset. Despite the growing exposure to foreign currency debt, comprehensive firm-level data on foreign currency liabilities, the currency breakdown of these liabilities, and their maturity structure remain sparse. The size of foreign currency debt may be underestimated, particularly in instances where firms issue debt abroad through special purpose vehicles or affiliates and do not consolidate these exposures in their balance sheets. Moreover, data on "natural" hedges from foreign currency revenue and financial hedges from derivatives are extremely limited.[12] Unless the collection of financial data on firms improves, data limitations will continue to complicate monitoring and risk management.

Corporate sectors are highly leveraged in some countries. Based on aggregate data for the nonfinancial corporate sector, debt-to-GDP ratios are highest in Bulgaria, China, Chile, Malaysia, Thailand, and Turkey (Figure 10, panel 3). In some countries, the ratio of corporate debt-to-GDP is close to levels seen during the Asia financial crisis. Based on firm-level data, however, corporate sector leverage measured by the median debt-to-income ratio is highest in Chile and Brazil, and lowest in most Asian countries, including China, Malaysia, and Thailand, in which corporate debt in percent of GDP is high (Figure 10, panel 5). The discrepancy between aggregate and firm-level measures can be due to a variety of reasons, for example, distribution of corporate debt by sector and firm size, GDP being an inaccurate proxy of corporate profitability, etc. Both measures provide valuable information: for instance, the weight of corporate debt in GDP is an indication of the potential cost to the economy should the corporate sector get into trouble, while the median debt-to-income ratio provides some information about the distribution of leverage across firms.

Highly leveraged corporate sectors also tend to have higher FX exposure, with a few notable exceptions. While China's debt is mostly denominated in local currency, Bulgaria, Chile, Hungary, Peru, and Turkey have sizable FX debt in share of GDP (Figure 10, panel 3). In most countries, FX debt is largely denominated in USD especially in Asia and Latin America but also in Turkey, while in emerging Europe (e.g., Bulgaria, Hungary, Poland), the euro and other currencies account for a larger share of total FX debt.

An assessment of the risks of increased FX exposure has to account for a number of factors: currency composition, extent of hedging, sectoral differences, and maturity structure.

Currency composition: Bulgaria and Hungary have a large share of corporate debt in FX, but their debt is largely denominated in euro, so their vulnerability to a USD shock is relatively contained;

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[12] The effectiveness of these financial hedges are also a concern as some derivative hedges are undertaken for the short term, and derivative instruments with knock-out features will terminate once the exchange rate depreciates beyond certain thresholds, thus rendering the hedge worthless.

however, they would be vulnerable to a depreciation against the euro, especially when natural hedge is small.

Hedging: A country is more vulnerable to a USD appreciation shock if it has a larger stock of USD debt while its income stream is mostly in domestic currencies or euro (Figure 10, panel 4). If FX leverage relative to natural hedges (defined as the ratio of FX debt to FX income) is relatively high, these countries could potentially be more vulnerable to a USD appreciation shock (Figure 10, panel 5). Though firms may be actively hedging through derivatives, especially in the tradable sectors, data limitations make the extent of hedging hard to quantify.

Sectoral differences: Capital intensive sectors such as utility, commodity exporters, and real estate/construction sectors are more leveraged than other sectors (Figure 11, panel 1).[13] Nontradable sectors have on average lower FX debt stock than tradable sectors, but they tend to generate less income in FX and financial hedging is rather uncommon in these sectors. Accounting for the natural hedges, some nontradable sectors, including utility and real estate sectors, are more vulnerable to exchange rate movement.
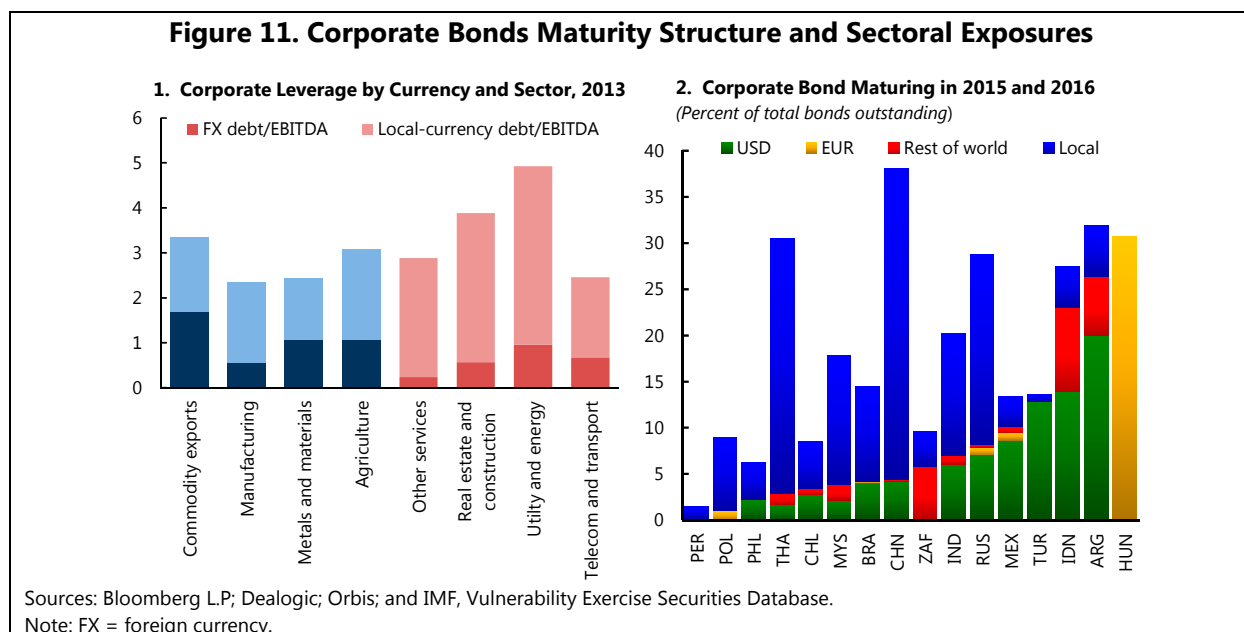
Maturity structure: Over time, the debt structure has shifted from bank loans to more corporate bonds issuances which generally have a relatively long-term maturity structure. Bonds maturing in the next two years as a share of total bonds outstanding are highest in Argentina, China, Hungary, Indonesia, Russia, and Thailand, and lowest in Chile, Peru, and the Philippines (Figure 11, panel 2). While most bonds maturing in Asia are in local currencies, Argentina, Hungary, and Indonesia have the highest share of FX bonds maturing by 2016.

As a result of higher corporate leverage and slowing profitability, debt servicing capacity has deteriorated in some countries. The median ICR computed as Earnings Before Interest and Taxation/Interest Expense has been declining in many countries, reflecting slowing growth and declining profitability, as well as higher corporate leverage (Figure 12, panels 1 to 3).[14] Countries where it is particularly low are Argentina, Brazil, Bulgaria, and India. As a result of the deterioration in debt-servicing capacity, the share of debt at risk (defined as debt of firms with an ICR below 1.5) in total corporate debt has risen by around 10 percent in 2013 relative to its five-year average, reaching 30 percent of total corporate debt (Figure 12, panel 4).[15]

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[13] The sectoral analysis is based on bond data from Dealogic.

[14] EBIT (also known as operating profit/loss) is used as a measure of earnings instead of EBITDA (earnings before interest, taxation, depreciation, and amortization) to account for the need for investment and replacement of assets.

[15] Debt at risk is defined as debt owed by firms where the ICR is below 1.5. An ICR of less than 1 implies that the firm is not generating sufficient revenues to service its debt without making adjustments, such as reducing operating costs, drawing down its cash reserves, or borrowing more. This analysis uses an ICR threshold of 1.5 times to take into account the potential vulnerabilities to funding risks, in addition to earnings risks, that could emanate in a scenario where funding liquidity thins, particularly during times of heightened global risk aversion. This is also a benchmark used widely by analysts as an early warning signal as firms with ICR below 1 may already be in distress.
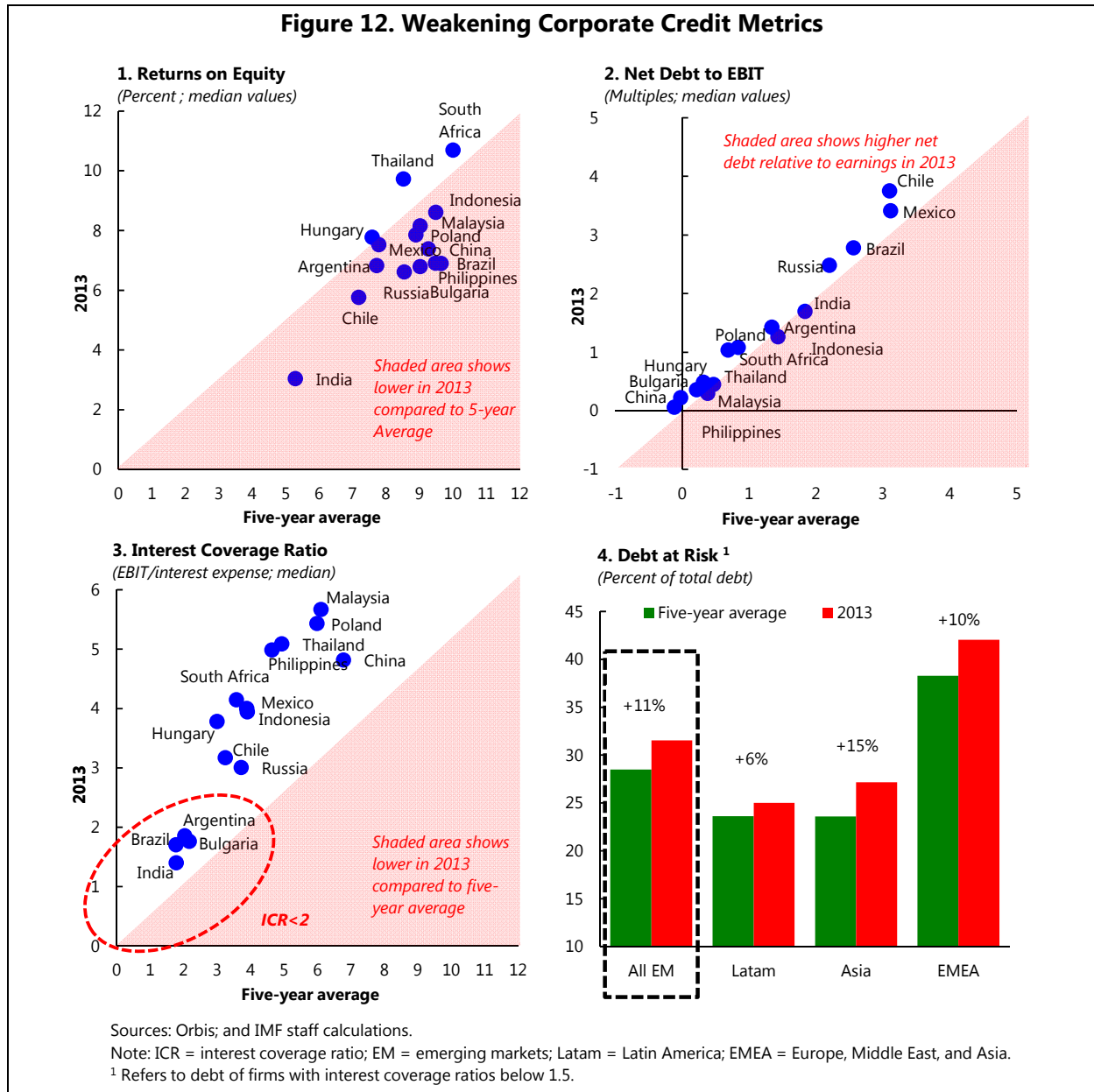
Figure 11. Corporate Bonds Maturity Structure and Sectoral Exposures

1. **Corporate Leverage by Currency and Sector, 2013**

2. **Corporate Bond Maturing in 2015 and 2016**
(Percent of total bonds outstanding)

Sources: Bloomberg L.P; Dealogic; Orbis; and IMF, Vulnerability Exercise Securities Database.
Note: FX = foreign currency.

Higher debt loads and lower debt-servicing capacity increase the corporate sector's sensitivity to macroeconomic and financial shocks. Exchange rate depreciation exposes firms to losses from the revaluation of FX debt service and the debt stock. At the same time, tighter external financing conditions could precipitate a rise in borrowing costs, and a further slowdown in economic growth could reduce earnings. To assess the adverse impact of such shocks on the health of the corporate sector, we conducted a stress test on a sample of companies in selected EMs (Appendix 1).[16] The magnitudes of the "severe but plausible" shocks for the stress scenarios are based on the following assumptions:

- A 30 percent increase in borrowing costs, derived from an average of the country median increase in firms' borrowing costs during the Global Financial Crisis. Country medians ranged from 3 percent to 69 percent.

- A 20 percent decline in earnings, based on an average of the country median decline in firms' EBIT during the Global Financial Crisis. Country medians ranged from an increase of 12 percent to a decline of 106 percent.

- An exchange rate depreciation of 30 percent against the USD based on USD appreciation of the late 1990s, and 15 percent depreciation against the euro to take into account the asynchronous U.S.-E.U. monetary policy.[17]

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[16] They include Argentina, Brazil, Bulgaria, Chile, China, Hungary, India, Indonesia, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, South Africa, and Thailand. Turkey is excluded due to the lack of a representative sample of firm-level data.

[17] We recognize that some currencies are pegged, or are in a heavily managed regime (e.g., the long-standing currency board arrangement in Bulgaria), which reduces the likelihood of such a scenario. This sensitivity analysis examines what could potentially happen in a very adverse scenario.

Figure 12. Weakening Corporate Credit Metrics

1. Returns on Equity
(Percent ; median values)

South Africa, Thailand, Indonesia, Malaysia, Poland, China, Hungary, Mexico, Argentina, Brazil, Philippines, Russia, Bulgaria, Chile, India

Shaded area shows lower in 2013 compared to 5-year Average

Y-axis: 2013 (0 to 12)
X-axis: Five-year average (0 to 12)

2. Net Debt to EBIT
(Multiples; median values)

Shaded area shows higher net debt relative to earnings in 2013

Chile, Mexico, Brazil, Russia, India, Argentina, Indonesia, Poland, South Africa, Hungary, Thailand, Bulgaria, China, Malaysia, Philippines

Y-axis: 2013 (-1 to 5)
X-axis: Five-year average (-1 to 5)

3. Interest Coverage Ratio
(EBIT/interest expense; median)

Malaysia, Poland, Thailand, China, Philippines, South Africa, Mexico, Indonesia, Hungary, Chile, Russia, Argentina, Brazil, Bulgaria, India

Shaded area shows lower in 2013 compared to five-year average

ICR<2

Y-axis: 2013 (0 to 6)
X-axis: Five-year average (0 to 12)

4. Debt at Risk [1]
(Percent of total debt)

Legend: Five-year average; 2013

All EM: +11%
Latam: +6%
Asia: +15%
EMEA: +10%

Y-axis: (10 to 45)

Sources: Orbis; and IMF staff calculations.
Note: ICR = interest coverage ratio; EM = emerging markets; Latam = Latin America; EMEA = Europe, Middle East, and Asia.
[1] Refers to debt of firms with interest coverage ratios below 1.5.

Potential hedges against FX losses are also taken into consideration based on the following assumptions:

- The "natural" hedge is FX gains from overseas earnings based on the share of foreign sales in total income. The currency breakdown of the natural hedge between the USD and the euro is derived from the trade weights, respectively with the United States and China and with the euro area. This may underestimate the share of total income which is USD or euro if trade with other countries is also invoiced in these currencies.

- Given the lack of data on financial hedging and the tenor and effectiveness of such hedges, an assumption that half of these FX liabilities are hedged is applied.
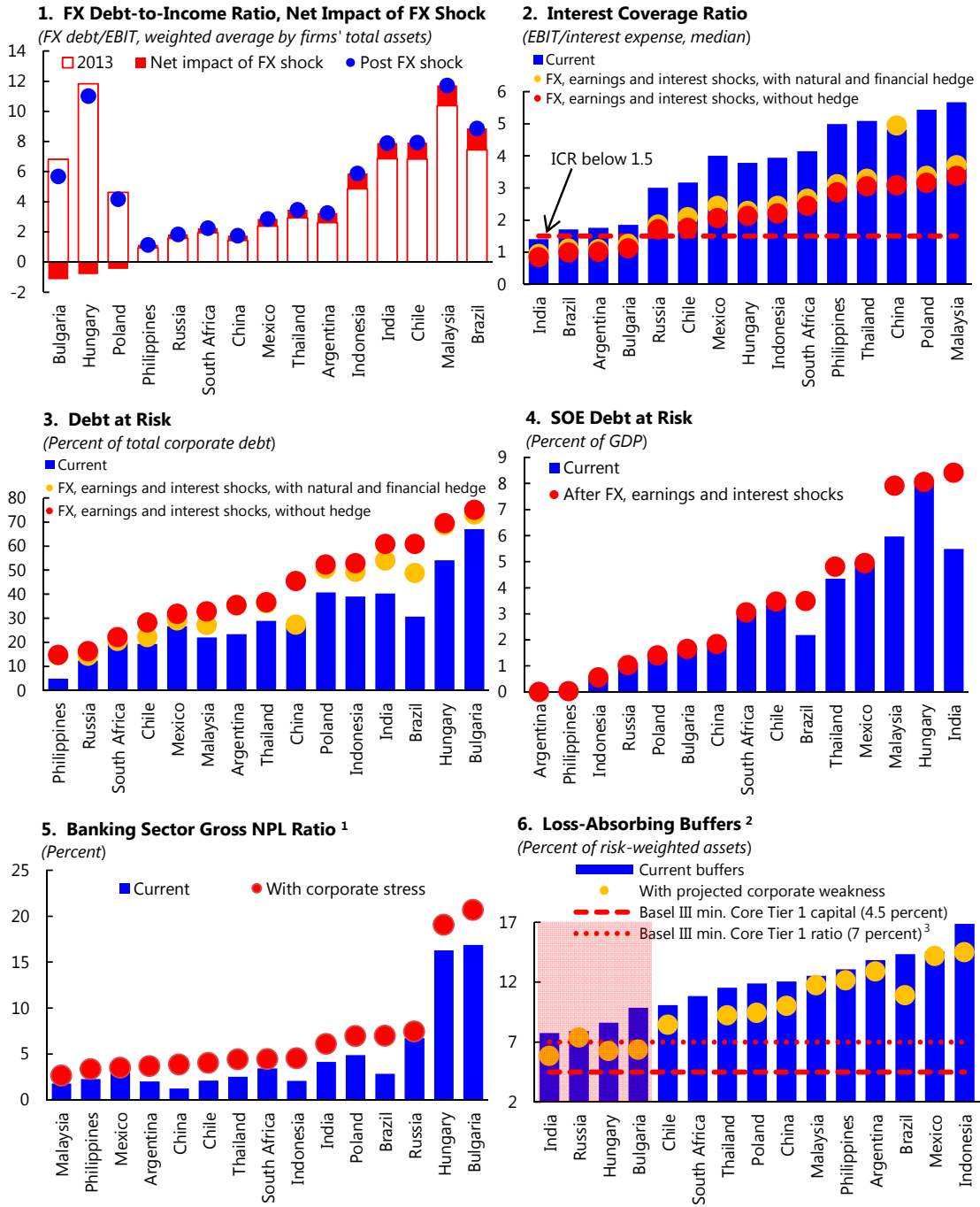
Countries with high FX leverage would be more susceptible to exchange rate volatilities. FX leverage defined as FX debt relative to total income is relatively high in Brazil, Bulgaria, Chile, Hungary, India, and Malaysia (Figure 13, panel 1).[18] Accordingly, in our stress test scenario, increases in FX leverage would be the largest in Brazil, Chile, India, Indonesia, and Malaysia. In contrast, FX leverage would be reduced in Bulgaria and Hungary, due to substantial increases in FX income. The lack of disclosure of FX debt maturity means, however, that the extent of potential FX losses from principal payments is unknown, but in general countries with high FX leverage are more susceptible to exchange rate risks due to the relatively large share of FX obligations. Moreover, while some countries may have larger overseas earnings that could provide some natural hedges, one should be careful that the effectiveness of these hedges may fall short of expectations. Past episodes have demonstrated that overseas revenues declined in tandem with the depreciation of local currencies during turbulent periods.

The combination of the shocks above—in particular the earning and interest rate shocks— would weaken debt servicing capacity and increase debt at risk. Debt servicing capacity is relevant in assessing short-term vulnerabilities. The stress test shows that the median ICR could decline significantly in most countries, reflecting to a large extent the shocks to borrowing cost and earnings (Figure 13, panel 2). Despite this decline, the median ICR remains comfortable for most countries, though it appears more worrisome for countries where the ratios are already weak (Argentina, Bulgaria, Brazil, India). Debt at risk (i.e., debt of firms with an ICR below 1.5) could rise above two-thirds of total corporate debt in Bulgaria and Hungary, from already high levels (Figure 13, panel 3). Within the sample of 15 countries, debt at risk of weak firms could increase by $290 billion, accounting for 34 percent of total corporate debt compared to 28 percent in 2013. While large firms continue to account for the bulk of the debt at risk in Asia and Latin America, in Europe, Middle East, and Africa one-third of the debt at risk is attributed to small and medium size firms. In a few countries (Brazil, India, Malaysia), debt at risk from state-owned enterprises could increase significantly. Debt at risk from state-owned enterprises could amount to more than 5 percent of GDP in India, Hungary, and Malaysia (Figure 13, panel 4).

Bank's buffers to withstand losses from such a scenario appear low in a few countries. Higher corporate default would erode banks' asset quality, and the ability of banks to withstand losses will depend on the extent of available buffers. Assuming that the aftershock corporate debt at risk owed to banks were to default with a probability of 15 percent suggests that buffers comprising Tier 1 capital and provisioning appear low in Bulgaria, Hungary, India, and Russia, when benchmarked against Basel III's minimum capital requirement (Figure 13, panels 5 and 6). In some cases, bank buffers may be overstated due to lax recognition of doubtful assets and loan forbearance. In such instances, loan losses in a severe downturn and higher corporate default could overwhelm what were thought to be adequate levels of equity capital. This is in line with findings of the IMF's April 2015 Global Financial Stability Report (IMF, 2015).

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[18] A high share of Brazil's corporate sector FX liabilities is currently hedged, though one cannot be certain of the hedge effectiveness throughout the tenor of the FX debt.

Figure 13. Corporate Stress Test and Impact on Banks

1. FX Debt-to-Income Ratio, Net Impact of FX Shock
(FX debt/EBIT, weighted average by firms' total assets)

Legend: 2013 | Net impact of FX shock | Post FX shock

Countries (x-axis): Bulgaria, Hungary, Poland, Philippines, Russia, South Africa, China, Mexico, Thailand, Argentina, Indonesia, India, Chile, Malaysia, Brazil

2. Interest Coverage Ratio
(EBIT/interest expense, median)

Legend: Current | FX, earnings and interest shocks, with natural and financial hedge | FX, earnings and interest shocks, without hedge

ICR below 1.5

Countries (x-axis): India, Brazil, Argentina, Bulgaria, Russia, Chile, Mexico, Hungary, Indonesia, South Africa, Philippines, Thailand, China, Poland, Malaysia

3. Debt at Risk
(Percent of total corporate debt)

Legend: Current | FX, earnings and interest shocks, with natural and financial hedge | FX, earnings and interest shocks, without hedge

Countries (x-axis): Philippines, Russia, South Africa, Chile, Mexico, Malaysia, Argentina, Thailand, China, Poland, Indonesia, India, Brazil, Hungary, Bulgaria

4. SOE Debt at Risk
(Percent of GDP)

Legend: Current | After FX, earnings and interest shocks

Countries (x-axis): Argentina, Philippines, Indonesia, Russia, Poland, Bulgaria, China, South Africa, Chile, Brazil, Thailand, Mexico, Malaysia, Hungary, India

5. Banking Sector Gross NPL Ratio [1]
(Percent)

Legend: Current | With corporate stress

Countries (x-axis): Malaysia, Philippines, Mexico, Argentina, China, Chile, Thailand, South Africa, Indonesia, India, Poland, Brazil, Russia, Hungary, Bulgaria

6. Loss-Absorbing Buffers [2]
(Percent of risk-weighted assets)

Legend: Current buffers | With projected corporate weakness | Basel III min. Core Tier 1 capital (4.5 percent) | Basel III min. Core Tier 1 ratio (7 percent) [3]

Countries (x-axis): India, Russia, Hungary, Bulgaria, Chile, South Africa, Thailand, Poland, China, Malaysia, Philippines, Argentina, Brazil, Mexico, Indonesia

Sources: Orbis; and IMF staff calculations.
Note: FX = foreign currency; ICR = interest coverage ratio; NPL = nonperforming loan; SOE = state-owned enterprise.
[1] Projected gross NPL ratios only consider shocks to the corporate loan portfolio (default probability of 15 percent from Moody's 1970–2012; recovery rates based on average between on Basel II and World Bank's rates). Exposures to households are excluded.
[2] Consist of Tier 1 capital and excess of loan loss reserves against the current stock of NPLs, normalized by risk-weighted assets.
[3] With capital conservation.

In conclusion, risks of EM crisis appear lower in the current USD appreciation episode, although there remain vulnerabilities. On the one hand, net FX external debt assets have improved substantially and countries have accumulated large FX reserves. On the other hand, fewer currencies are tied to the USD, especially among systemic EMs, which should allow for a more gradual depreciation of exchange rates. But there remain macro-level balance sheet vulnerabilities to a USD appreciation, especially in some countries of emerging Europe and the CIS. In the corporate sector where leverage has increased much, debt servicing capacity has deteriorated. Should a combination of severe macroeconomic shocks affect the nonfinancial sector, debt at risk would further rise, putting pressure on banking systems' buffers, especially in countries where corporate and banking sectors are already weak.

APPENDIX 1. METHODOLOGY FOR CORPORATE SENSITIVITY ANALYSIS[19]

A. Estimating the share of corporate external debt

As the breakdown of firm-by-firm foreign currency borrowing is not available through Orbis and other in-house databases, such debts are approximated, at the aggregate level, by external debt statistics and other sources as follows:

Sources of Corporate Borrowing	Data
Foreign currency debt	IMF's Vulnerability Exercise Securities database
Domestic banks	Banking system data from "Financial Soundness Indicators"
Domestic capital markets	Bloomberg

The share of aggregate corporate external debt to total corporate debt is estimated as:

$$\frac{\text{Foreign Currency Debt}}{\text{Foreign Currency Debt} + \text{Loans from Domestic Banks} + \text{Borrowings from Domestic Capital Markets}}$$

B. Estimating the impact of FX movements

FX movement impacts firms through two channels:

Interest payments due in the current year

Exchange rate depreciation would increase the interest burden from FX debts. This is estimated as:

$$\text{Share of External Debt x Borrowing Cost x Total Debt x} \left[\left(\begin{array}{c} \text{Share of USD Debt x Nominal Exch. Rate} \\ \text{Depreciation vs. USD} \end{array} \right) \right.$$
$$\left. + \left(\text{Share of EUR Debt x Nominal Exch. Rate Depreciation vs. EUR} \right) \right]$$

The proportion of debts denominated in USD and EUR is approximated by the share of USD and EUR bonds from Dealogic.

Revaluation of loan and bond principal[20]

In the absence of information on the maturity structure of bank loans, we cannot compute realized FX loss from principal revaluation for the current period; instead, we present the impact on the total stock of debt including loss to be materialized in the future periods.

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[19] This follows the methodology used in the analysis of emerging market corporate vulnerability in the April 2014 Global Financial Stability Report (IMF, 2014).

[20] In line with IFRS 13 (fair valuation of liabilities).

FX loss on foreign currency debt principal is computed as:

$$\text{Share of External Debt x Total Debt x [(Share of USD Debt x Nominal Exch. Rate Depreciation vs. USD)} + \text{(Share of EUR Debt x Nominal Exch. Rate Depreciation vs. EUR)]}$$

We compare FX debt to total income ratio before and after an FX shock. First, we compute ratios at the firm level and then we aggregate to the country level by weighting the ratios by the size of assets to account for the relative importance of large firms.

C. Accounting for Natural Hedges

FX losses from interest expense and revaluation of foreign currency debt principal are offset by FX gains from overseas earnings, computed as:

Share of Foreign Sales x EBIT x [(Share of USD Revenue x Nominal Exch. Rate Depreciation vs. USD) + (Share of EUR Revenue x Nominal Exch. Rate Depreciation vs. EUR)]

Assumptions underlying this estimation are:

- Foreign sales are assumed to be in foreign currencies.

- The share of FX revenues is derived from the country trade weights. USD share of income refers to share of income earned through trade with the United States and China; EUR share refers to trade proceeds with euro area, and the remaining FX proceeds are assumed to be denominated in other currencies. This approach to account for natural hedges has several caveats. First, trade with countries other than the United States, China, and euro area maybe invoiced in USD (e.g., Turkey's trade with the Middle East [one-fifth of total trade]); and second, we fail to account for dollarization transactions which should be considered natural hedge even though revenues are from domestic sources.

- The multiplication by EBIT (operating profit) effectively takes into account foreign currency costs as it assumes that the share of these costs are in proportion to foreign currency incomes.

It is worth noting that the effectiveness of natural hedges is an approximation as it may fall short of expectations. Past episodes have demonstrated that overseas revenues declined in tandem with the depreciating currencies during turbulent periods.

D. Accounting for Financial Hedges

Currency hedging of foreign currency debts could also mitigate potential FX losses. Offset from financial hedging of foreign currency debt service is computed as:

Hedge Ratio x FX losses from FX debt interest

As information on financial hedging is sparse, this analysis assumes that at least 50 percent of foreign currency debts are hedged, on aggregate basis.

E.   Estimating Nonperforming Loans and Banks' Buffers

The corporate nonperforming loans were projected from the aftershock corporate debt at risk owed to banks as follows:

Corporate Nonperforming Loan After Shock = Probability of Default x Corporate Loan at Risk x Loss Given Default

- *Probability of default:* With debt at risk defined as those with ICR below 1.5, the probability of default can be approximated as 15 percent.[21]

- *Corporate loan at risk:* This is derived from the scaling of the sample total debt and aftershock debt at risk by the amount of total lending to the nonfinancial corporate sector.

- *Loss given default:* This is derived from an average of the World Bank's loss given default rate for each country[22] and 45 percent. [23]

The aftershock loss absorbing buffers can be computed as:

(Tier 1 Capital + Loan Loss Reserves – Existing Stock of Nonperforming Loans – Projected Increase in Nonperforming Loans)/ Risk-Weighted Assets

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[21] Based on Moody's default probability for corporate debts with ICR of 1.5 for a three-year horizon from 1970–2012.

[22] See http://www.doingbusiness.org/data/exploretopics/resolving-insolvency. Loss given default is computed as 1-Recovery Rate.

[23] Based on the Bank for International Settlements' loss given default for senior claims on firms, sovereigns, and banks not secured by recognized collateral.

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