LAPSE OF TIME

SM/20/92

May 1, 2020

To: Members of the Executive Board

From: The Secretary

Subject: **April 2020 Global Financial Stability Report—Analytical Chapter 3**

Board Action:	Further to the Executive Board discussion on April 7, 2020, this Analytical Chapter of the Global Financial Stability Report is being circulated for **Executive Directors' comments** in advance of publication.
Deadline to Provide Comments:	**Friday, May 15, 2020** **12:00 (noon)**
Publication:	Proposed, after Friday, May 15, 2020
Questions:	Mr. Natalucci, MCM (ext. 37108) Mr. Ilyina, MCM (ext. 35351) Mr. Papageorgiou, MCM (ext. 34261)
Additional Information:	The paper will be revised for publication in light of the comments from Executive Directors. If Executive Directors have comments, they should notify Mr. Natalucci (ext. 37108), Ms. Ilyina (ext. 35351), and Mr. Papageorgiou (ext. 34261) by **12:00 p.m. on Friday, May 15, 2020.**

CHAPTER 3

EMERGING AND FRONTIER MARKETS

CONTENTS

FIGURES

TABLES

Managing Volatile Portfolio Flows

Chapter 3 at a Glance

- The COVID-19 pandemic has led to an unprecedented sharp reversal of portfolio flows highlighting challenges of managing volatile portfolio flows in emerging and frontier markets.

This chapter shows that:

- Changes in global financial conditions tend to influence portfolio flows more during surges and reversals than in normal times.
- Stronger domestic fundamentals do not always lead to surges in portfolio flows but do help mitigate outflows.
- Greater foreign investor participation in local currency bond markets can help reduce borrowing costs, but it may also increase price volatility where domestic markets lack depth, especially frontier markets.

The dramatic reversal of emerging market portfolio flows following the global spread of COVID-19 highlights the challenges of managing volatile portfolio flows and risks they may pose to financial stability. A prolonged period of low interest rates had encouraged both borrowers and lenders to take on more risk. Surges of portfolio inflows into riskier asset markets contributed to the buildup of debt and, in some cases, resulted in stretched valuations. This chapter quantifies the sensitivities of different types of portfolio flows and the associated cost of funding to global and domestic factors during "normal" times as well as during periods of weak or strong flows. Analysis suggests that both bond and equity flows are much more sensitive to global financial conditions during periods of extreme flows than in normal times, while domestic fundamentals may matter incrementally more for equities and local currency bond flows. Furthermore, greater foreign investor participation in local currency bond markets that lack adequate depth can greatly increase the volatility of bond yields. Dealing with immediate capital outflow pressures calls for using reserves to reduce excessive volatility, deploying capital flow management measures, and preparing for long-term external funding disruptions.

Foreign Funding in Times of Uncertainty

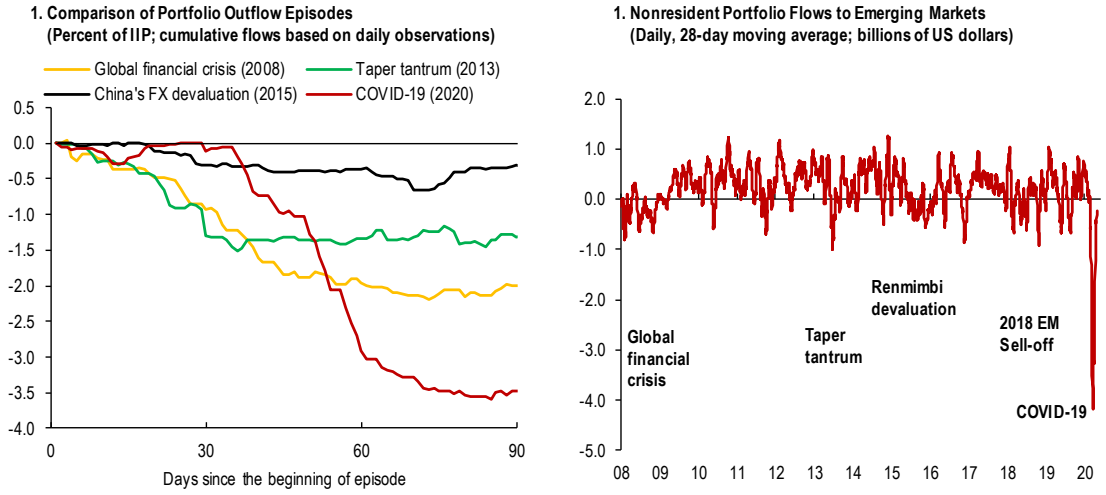
1. The COVID-19 pandemic has led to historic portfolio outflows from emerging and frontier markets (see also Chapter 1). After a strong resumption of portfolio flows to emerging markets through early 2020, driven by increased optimism about economic recovery amid easing trade tensions, total portfolio flows reversed dramatically in March, with more than $100bn of outflows (or 3½ percent of asset holdings) since January 21, led initially by equity outflows (Figure 3.1, panel 1). The volatility of nonresident flows to equity and local currency bond

The authors of this chapter are Reinout De Bock, Dimitris Drakopoulos, Rohit Goel, Lucyna Gornicka, Evan Papageorgiou (team leader), Patrick Schneider, and Can Sever, under the guidance of Fabio Natalucci and Anna Ilyina.

Figure 3.1. Recent Trends in Portfolio Flows to Emerging Markets

Concerns about the economic fallout of the COVID-19 pandemic on emerging markets led to strong portfolio outflows…

…as well as historically high volatility at the trough of the sell-off.



Sources: IMF, World Economic Outlook database; national authorities; and IMF staff calculations.
Note: Economies included in panel 2 are: China, Brazil, Hungary, India, Indonesia, Korea, Mexico, Pakistan, Philippines, Qatar, Sri Lanka, South Africa, Taiwan Province of China, Thailand, and Ukraine. EM = emerging market; FX = foreign exchange; IIP = international investment position.

markets during the trough of the selloff reached unprecedented levels, despite policy rate cuts and measures to support economic activity (Figure 3.1, panel 2).

2. Foreign portfolio flows are an important source of funding for emerging market sovereigns and corporations. Nonresident portfolio investment can help expand and diversify the investor base for emerging market assets, lower the cost of funding, and ultimately contribute to stronger economic growth and economic development (see Hannan 2018 for a literature review). However, reliance on foreign financing can also entail risks. Heightened uncertainty in the global economy resulting from trade tensions, geopolitical events, and pandemics (as is currently the case with COVID-19) can lead to a significant tightening of global financial conditions and increased portfolio flow volatility. Moreover, the strong and persistent portfolio inflows seen in earlier periods can create vulnerabilities by encouraging excessive domestic credit creation and an overvaluation of local currency and other financial assets. These risks need to be managed.

3. Emerging and frontier markets have become more reliant on foreign portfolio flows over the years. Foreign participation in emerging and frontier markets[1] has grown significantly in the 10 years since the global financial crisis, aided by accommodative policies in advanced economies (Figure 3.2, panel 1). Foreign debt portfolio investment in frontier market economies has risen rapidly and is now on par with cross-border loans. Even in equity markets, where

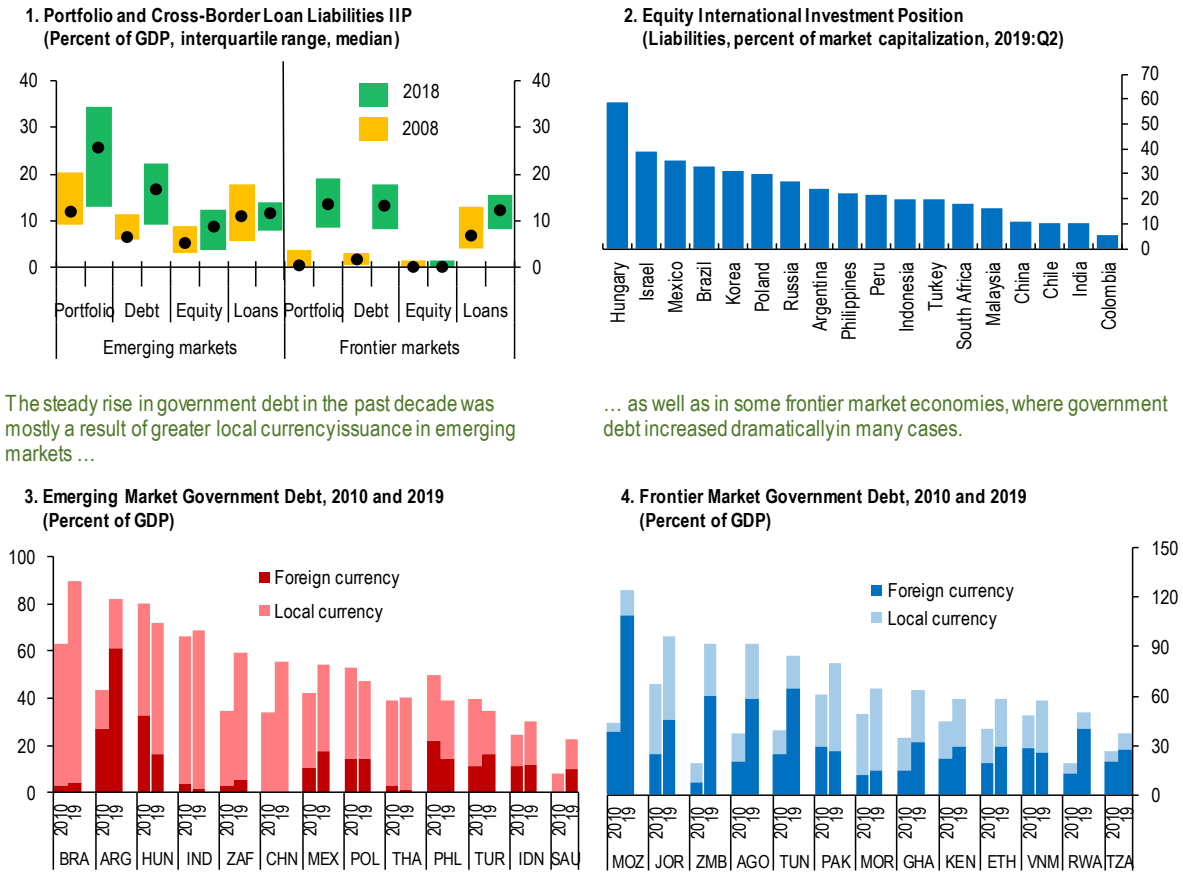
[1]See Online Annex 3.1 for definitions of frontier market economies. All annexes are available at www.imf.org/en/Publications/GFSR.

nonresident participation has traditionally been smaller than in debt markets, foreign investors currently own a significant share of outstanding assets in some countries (Figure 3.2, panel 2).

Figure 3.2. Emerging and Frontier Market Economy Debt

Portfolio investment has grown quickly for most emerging and frontier market economies, led by debt.

Foreign participation in equity markets is also significant in some emerging market economies.



Sources: Bloomberg Finance L.P.; IMF, World Economic Outlook database; JPMorgan Chase & Co; and IMF staff calculations.
Note: For more information on the sample of countries see Online Annex 3.1. "Portfolio" is the sum of debt and equity, excluding loans; the interquartile range is calculated separately. In panels 5 and 6, data labels use International Organization for Standardization country codes. EMs = emerging markets; IIP = international investment position; UAE = United Arab Emirates.

4. Risks related to portfolio flows may be more acute in the context of high levels of overall debt in emerging market economies. Total debt for the median emerging market economy rose to 100 percent of GDP in 2018 from 75 percent before the global financial crisis, and to more than 250 percent of GDP in China from 140 percent in 2007. These increases are the result of greater public sector borrowing in many emerging markets and a strong rise in corporate sector leverage in China.

5. Many emerging market sovereigns have stepped up issuance of local currency debt in recent years (Figure 3.2, panels 3 and 4). At face value, this reduction in the so-called "original sin" affords countries greater insurance from episodes of domestic currency volatility or

tightening of external financial conditions. But increased foreign participation in debt markets, particularly in many frontier market economies, exposes them to changes in global financial conditions through the behavior and preferences of foreign investors, such as the current volatility around the COVID-19 pandemic. During periods of risk aversion, when local currencies weaken and domestic assets sell off, foreign investors are likely to reduce their exposure and might not roll over maturing positions, thereby triggering outflows, which could disrupt bond markets. Even in the absence of outflows, increased foreign currency hedging could exert substantial pressure on the exchange rate and the cost of funding.

6. This chapter aims to provide an empirical assessment of the trade-offs between raising additional foreign funding or reducing funding costs, on one hand, and increasing rollover risks or volatility in asset prices, on the other. The analysis involves two elements:

- *Dynamics of portfolio flows:* The drivers of nonresident bond and equity portfolio flows to emerging markets during surges and reversals and in normal times, and
- *Funding costs:* The sensitivity of the level and volatility of funding costs to portfolio flows and other domestic and common global factors, including the capacity of domestic institutional factors to mitigate the volatility of funding costs.

7. The empirical analysis presented in this chapter shows that the outlook for debt flows tends to be influenced more by global (common) factors than by country-specific (idiosyncratic) factors, while the outlook for equity flows is more heavily influenced by domestic factors, such as growth. For both bond and equity flows, changes in global financial conditions tend to affect the "tails" of their predicted portfolio flow distributions (the likelihood of future surges or reversals) more than the likelihood of median flows. The outlook for local currency bond flows has greater sensitivity to domestic vulnerabilities than the outlook for hard currency (primarily dollar and euro) bond flows. For instance, strong growth prospects can limit the likelihood of future outflows from local currency bond markets but can also amplify future surges. Domestic bond yields are highly sensitive to external factors, especially for low-rated economies. The current circumstances of large outflows due to the COVID-19 global health emergency illustrate the effects of tighter global financial conditions and lower domestic growth prospects on different types of portfolio flows.

8. The findings from the empirical analysis can be used to assess the circumstances under which reliance on foreign investors (such as by frontier market economies) may be considered excessive, given the state of these countries' fundamentals. The analysis in this chapter suggests that a rise in foreign investor participation in the local currency bond market beyond a certain critical threshold—controlling for the domestic investor base—can significantly increase yield volatility. However, greater depth of domestic financial markets and the local investor base can help reduce the volatility of local currency bond prices. Some frontier markets already exceed that threshold. The high secondary market bond price volatility during the first quarter of 2020 under the COVID-19 shock underscores the need to find a better balance between attracting foreign investors and further developing their financial markets, particularly for frontier market economies. This includes improving the liquidity of foreign currency markets and the availability of hedging instruments.

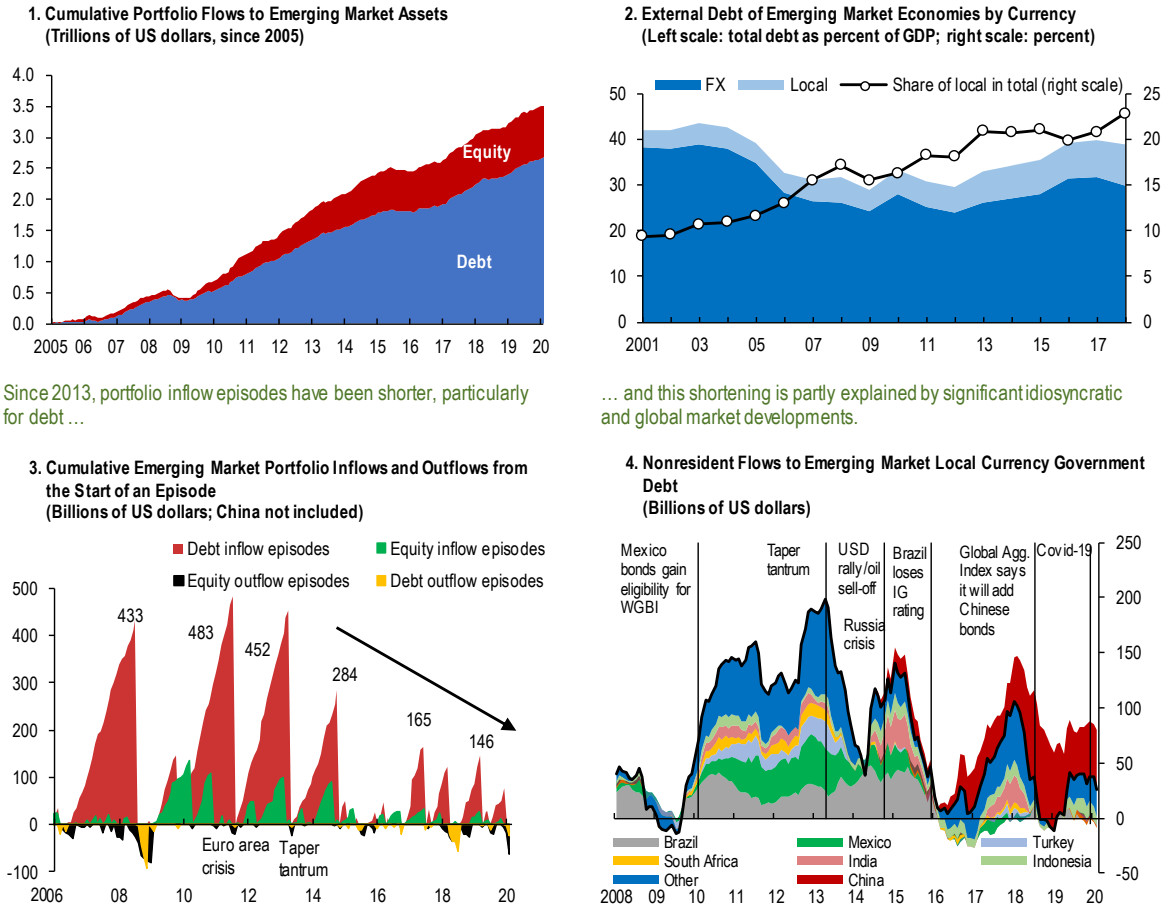
Some Stylized Facts

9. Nonresident bond portfolio flows dominate equity flows in aggregate, given the larger investible universe of assets and the postcrisis boost from lower global rates (Figure 3.3, panel 1). Foreign portfolio investment in emerging market debt is still predominantly in foreign currencies, but consistent with the reduction in "original sin," there has been a long-term shift to debt denominated in local currencies since the Asian financial crisis (Figure 3.3, panel 2).

Figure 3.3. Trends in Portfolio Flows to Emerging Markets

Nonresident emerging market portfolio flows have traditionally been significantly bigger for debt than for equities.

The share of foreign participation in local currency debt markets grew from 10 percent of the total in 2000 to almost 25 percent recently.



Sources: Bloomberg Finance L.P.; EPFR Global; Institute for International Finance; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Panel 2: China is not included. Panel 3: inflow (outflow) episodes are reset at the first monthly occurrence of outflows (inflows). EM = emerging market; EMEA = Europe, Middle East, and Africa; FX = foreign currency; IG = investment-grade; USD = US dollar; WGBI = World Government Bond Index.

10. Portfolio flows to emerging markets have been more volatile since the global financial crisis compared with the previous decade. Since 2013 the periods of inflows have become shorter, while outflow episodes have lasted longer (Figure 3.3, panel 4). Equity portfolio flows to emerging markets (excluding China) have been especially volatile in recent years. And despite a

generally benign global economic backdrop, steady year-to-date inflows came to a sudden halt in August 2019 on fears about an escalation of US–China trade tensions and the outcome of the primary election in Argentina.

11. Developments in local currency government bond markets have played an important role in shaping debt portfolio flow trends (Figure 3.3, panel 5), given the increasing share of local-currency-denominated external debt (Figure 3.3, panel 2). Watershed events for large emerging market economies—such as inclusions in global bond indices (China, Mexico, South Africa) or crises elsewhere (Brazil, Russia)—along with large systemic events—such as the taper tantrum, synchronized central bank easing, and the emerging market sell-off in 2018—have had large effects on aggregate portfolio inflows to emerging market economies.

Key Drivers of Portfolio Flows to Emerging Markets

12. Factors driving surges of portfolio inflows to emerging markets may differ from factors driving large outflows.[2] The extensive literature on capital flows has stressed the role of both domestic "pull" and global "push" factors in explaining dynamics of flows to emerging markets.[3] However, almost all of the past work has looked separately, on one hand, at the drivers of average capital flows and, on the other, at the drivers of capital flow surges and sudden stops. In contrast, the analytical framework of the capital-flows-at-risk methodology (see Online Annex 4.1) considers the joint impact of multiple drivers on the entire predicted distribution of portfolio flows.[4] Looking at the distribution of future flows is a way of quantifying a likelihood of extreme outcomes that could potentially lead to financial instability. From a policy perspective, this could help policymakers prepare for future reversals or surges of portfolio flows.

13. In this chapter, the capital-flows-at-risk methodology is used to study the impact of global and domestic factors on total debt and equity portfolio flows to emerging markets and on hard currency versus local currency debt flows. The analysis focuses on the predicted distributions of portfolio flows over the near term (the current quarter and the next two quarters) based on global factors in the current period and on domestic factors prevailing in the previous period. Figure 3.4 shows two stylized distributions of portfolio flows—the gray line is the predicted distribution conditional on factors observed at time t, and the dashed blue line is the predicted distribution conditional on factors at time $t + 1$. The figure shows that a change in either global or domestic conditions between t and $t + 1$ contributed to an improved outlook for portfolio flows, including a significantly lower likelihood of outflows and a higher likelihood of strong inflows, conditional on other factors being fixed.

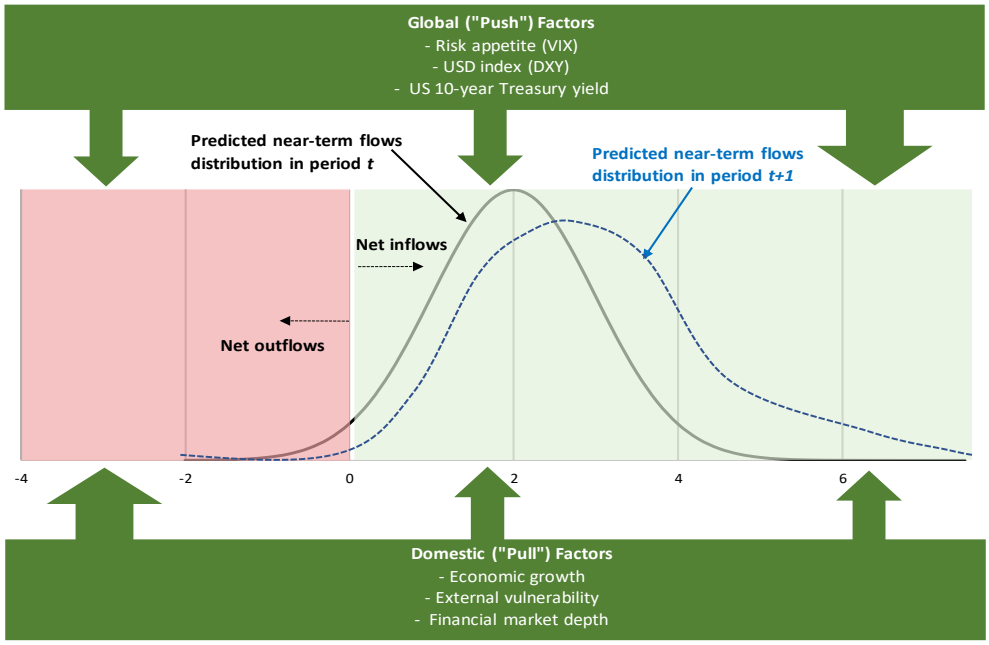
---

[2]Calvo and Reinhart (1999); Guidotti, Sturzenegger, and Villar (2004); and Cecchetti and others (2020) discuss the risks of portfolio flows in periods of "sudden stops" and "surges."

[3]See Koepke (2019) for an overview of the literature.

[4]For details of the capital-flows-at-risk methodology, see the October 2018 *Global Financial Stability Report* (GFSR), and Gelos and others (2019). For more information on the model specifications used in this chapter, see Online Annex 4.1.

Figure 3.4. Effects of Global and Domestic Factors on the Distribution of Predicted Portfolio Flows



Source: IMF staff.
Note: The gray density function is an example of a predicted density of near-term portfolio flows distribution. The predicted distribution is state-contingent; that is, it depends on the global and domestic factors in a given period. Changes in the domestic or global factors over time induce shifts in the predicted distribution. The blue density function shows a rightward shift of the predicted density of near-term flows, which could be caused, for example, by easing in global funding conditions. This change—all else equal—is associated with a reduced likelihood of net outflows and with a higher likelihood of very large inflows. In addition, the likelihood of very large inflows increases by more than the likelihood of net outflow declines. See Online Annex 4.1 for details. DXY = US Dollar Index; VIX = Chicago Board Options Exchange Volatility Index.

14. The capital-flows-at-risk approach used in this chapter highlights the differential effects of global and domestic factors on the likelihood of negative or weak flows in contrast to the likelihood of moderate or strong flows. For example, changes in certain factors can have a larger effect on the likelihood of outflows than on the rest of the expected distribution of portfolio flows. The analysis in this chapter focuses on nonresident flows, referred to as "gross inflows" in the literature. In the baseline specification, the portfolio flows (in percent of GDP) are regressed on the Chicago Board Options Exchange Volatility Index (VIX), US Dollar Index, US 10-year Treasury yield, and lagged domestic drivers (domestic GDP growth, the ratio of short-term foreign exchange debt to international reserves, the depth of domestic financial markets, GDP per capita, and capital account openness). All regressions include country fixed effects and period dummies prior to, during, and following the global financial crisis. When discussing the results of quantile regressions, the interpretation focuses on the directional impact of different factors on the likelihood of observing weak or strong flows, conditional on other factors being fixed.

15. Based on the literature, tightening in global funding conditions would be expected to worsen the outlook for near-term portfolio flows. Similarly, weaker growth and more shallow domestic financial markets should worsen the outlook for portfolio flows across the board. At

the same time, higher levels of external debt could have differential effects on portfolio flows at different percentiles. For example, a higher level of debt today could increase short-term financing needs—and thus future inflows—or it could lead to a decline in flows because of concerns about debt sustainability.

Debt versus Equity Portfolio Flows

16. For debt portfolio flows, changes in global conditions disproportionately affect the outlook for large inflows. In contrast, changes in domestic fundamentals seem to contribute more to the likelihood of negative or weak inflows than to the likelihood of large inflows. Intuitively, positive global risk sentiment can quickly boost portfolio inflows as investors search for yield, but when risk appetite deteriorates, investors tend to pay more attention to domestic factors, leading to larger pullbacks from countries with weaker fundamentals.[5] The sensitivities to specific factors vary:

- As expected, easier global financial conditions today boost the near-term outlook for debt portfolio flows across the board (that is, the entire distribution of predicted flows in Figure 3.4 moves to the right). This is also the case when considering individual factors that make external borrowing cheaper or change the risk-adjusted returns in favor of emerging markets—lower volatility (VIX), lower US Treasury yields, and a weaker US dollar. But a closer look at the individual global factors reveals important differences (Figure 3.5, panels 1–4). Lower US Treasury bond yields and a weaker US dollar (or equivalently, stronger domestic currencies) increase the likelihood of strong debt portfolio inflows by considerably more than they decrease the likelihood of negative or weak flows. This could be because debt managers often try to take advantage of favorable funding conditions to arrange funding in advance (prefinance). In contrast, risk aversion among global investors—measured by the VIX—affects the outlook for strong and weak flows in roughly equal magnitudes.
- While stronger domestic fundamentals do not necessarily lead to surges in portfolio inflows, they often help reduce the likelihood of outflows. Stronger domestic growth is associated with a smaller likelihood of negative or weak inflows but does not seem by itself to increase the likelihood of very large inflows. Greater external vulnerabilities (measured by a higher level of short-term foreign currency debt relative to international reserves) are linked to a larger likelihood of negative or weak debt inflows in the near term (Figure 3.5, panel 5). When the level of short-term debt is higher today, the likelihood of very strong inflows increases too, but to a lesser extent. This positive impact potentially reflects greater refinancing needs in countries with higher levels of short-term debt, as well as investors' confidence in successful debt redemption.

[5]For example, as shown by Milesi-Ferretti and Tille (2010), countries with larger external or domestic vulnerabilities also experienced a larger retrenchment in capital flows during the global financial crisis.

Moreover, deeper domestic financial markets improve the outlook for debt flows across the board (Figure 3.5, panel 6).

17. The results discussed above also suggest that the COVID-19 shock has considerably weakened the outlook for debt inflows. The downgraded GDP forecasts imply a greater likelihood of weak or negative flows, while tightened global financial conditions reduce the likelihood of large inflows, at least in the near term. The magnitude of the deterioration in the near-term outlook is comparable to the one observed during the global financial crisis, with the strengthening of the US dollar and higher market volatility alone weakening the median predicted quarterly flows by 1 percent of GDP for an average emerging market economy.[6]

18. Equity portfolio flows are also influenced by global and domestic factors, but in a different way. A similar specification of the quantile regression for equity flows (Figure 3.5, panels 3–5) shows some notable differences:[7]

- Equity flows seem to be less sensitive to global factors than debt flows. Among global factors, the disproportionately larger impact on the likelihood of strong inflows (compared with weak inflows) is present only for debt portfolio flows. In particular, a stronger US dollar weakens the near-term outlook for equity flows across the board, but its impact is an order of magnitude smaller than for debt flows.[8]
- Domestic fundamentals have a similar qualitative impact on both debt and equity flows, but—in line with intuition—stronger domestic growth contributes to an increased likelihood of strong equity inflows more than it improves the likelihood of strong debt inflows, while overall debt sustainability (as proxied by the ratio of short-term foreign currency debt to international reserves) seems to be more relevant for debt flows. In the context of the COVID-19 crisis, weakened growth prospects for emerging markets will worsen the outlook for equity portfolio flows more than for debt portfolio flows. Deeper domestic financial markets do not seem to matter when it comes to reducing the likelihood of negative or weak equity inflows in the same way as they do for debt flows.[9]

[6]During the last quarter of 2008, the US Dollar Index and the VIX increased by about 10.5 points and 33.5 points, respectively. As of mid-March 2020, the US Dollar Index and the VIX were 10.5 points and 43 points higher, respectively, than at the end of 2019.

[7]Figures 3.5 and 3.6 show nonstandardized coefficients for different variables. The findings presented in this chapter also hold when comparing standardized coefficients (reported in Online Annex 3.1).

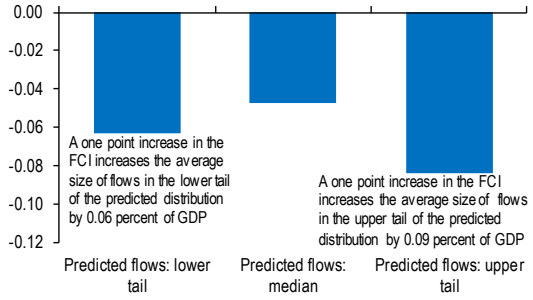
[8]This is in line with Li, de Haan, and Scholtens (2018), which finds that weaker domestic currency provides earnings support to exporters in an economy, thus boosting growth and equity flows.

[9]The literature suggests that financial market depth can mitigate the impact of global shocks on portfolio flows by softening the asset price response to these shocks. For the role of institutional factors in capital flows, see Alfaro, Kalemli-Ozcan, and Volosovych (2008).

Figure 3.5. What Drives Debt and Equity Portfolio Flows to Emerging Markets?

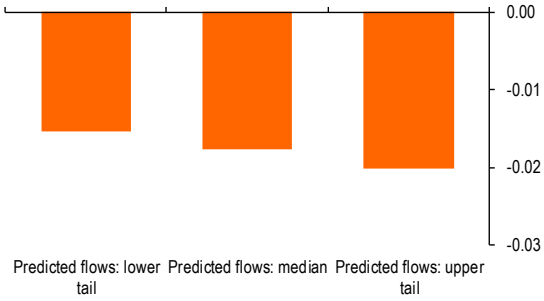
Tighter global financial conditions today decrease near-term debt flows in general.

1. Coefficients on the Global Financial Conditions Index (FCI) from Quantile Regressions of Near-Term Debt Portfolio Flows



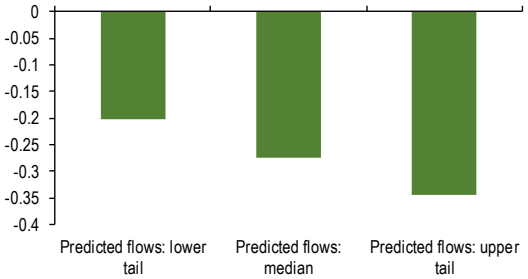
The risk aversion of global investors affects the outlook for debt flows across the board …

2. Coefficients on the VIX from Quantile Regressions of Near-Term Debt Portfolio Flows



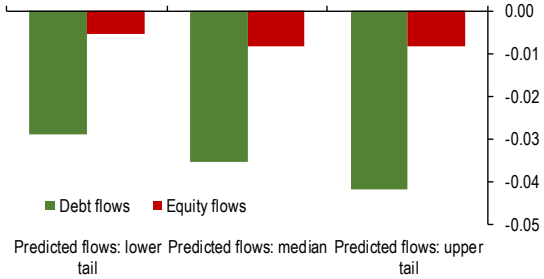
… while higher global interest rates disproportionately limit the likelihood of very large inflows.

3. Coefficients on the US Sovereign 10-Year Yields from Quantile Regressions of Near-Term Debt Portfolio Flows



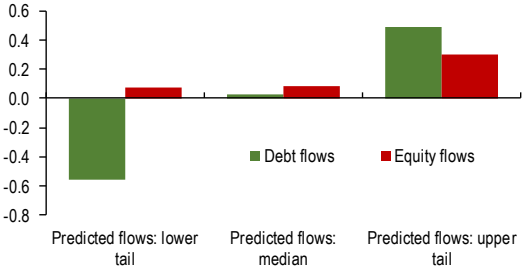
A stronger US dollar reduces the likelihood of strong flows more than it increases the likelihood of weak or negative flows, more so for debt flows than for equity flows.

4. Coefficients on the US Dollar Index from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows



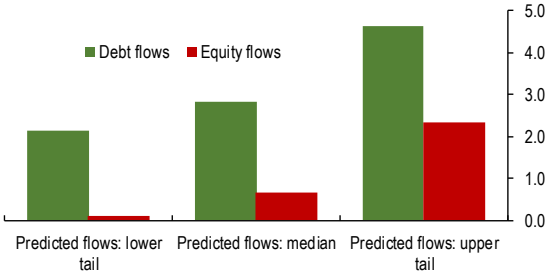
Higher debt vulnerability is negative for debt flows in general, but it increases the likelihood of negative or weak inflows much more than it increases the likelihood of large inflows.

5. Coefficients on the Ratio of Short-Term Foreign Currency Debt to Reserves from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows



Deeper financial markets reduce the likelihood of negative or weak debt inflows and increase the likelihood of large inflows of both types of flows.

6. Coefficients on the Depth of Domestic Financial Markets Index from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows



Sources: IMF, International Financial Statistics, Financial Flows Analytics, and Assessing Reserve Adequacy databases; World Bank; and IMF staff calculations.
Note: The reported coefficients come from quantile regressions of average quarterly debt or equity portfolio inflows in the current and next two quarters (as a percent of GDP) on a range of global and (lagged) domestic factors for a panel of emerging and frontier markets. The lower tail corresponds to average coefficients on explanatory variables from regressions for low percentiles (5th, 10th, 20th, 30th); median flows correspond to average coefficients from regressions for middle percentiles (40th, 50th, 60th); and upper tail corresponds to average coefficients for upper percentiles (70th, 80th, 90th, 95th). See Online Annex 4.1 for details. FCI = Financial Conditions Index; VIX = Chicago Board Options Exchange Volatility Index.

Hard Currency versus Local Currency Debt Portfolio Flows

19. While better domestic fundamentals and economic prospects improve the outlook for both local and hard currency debt portfolio flows, local currency flows are more sensitive to domestic factors than hard currency flows:

- Local currency debt flows appear to be more sensitive to the level of external vulnerabilities than hard currency debt flows. A higher level of short-term debt and weaker reserve adequacy significantly increase the likelihood of negative or weak inflows, especially for local currency flows (Figure 3.6, panel 1).[10] For example, a 1 percentage point rise in the ratio of short-term debt to international reserves could lower the local currency debt flows at risk[11] by 0.4 percent of GDP and hard currency debt flows at risk by 0.2 percent of GDP.[12]

- Local currency debt flows are more sensitive to domestic growth prospects than hard currency debt flows, especially the likelihood of extreme flows. Higher growth boosts expected flows but affects the tails of the portfolio flow distribution twice as much (Figure 3.6, panel 2). This also means that better growth prospects limit the likelihood of weak or negative inflows, but also amplify the likelihood of very large inflows. The outlook for local currency flows is almost three times more sensitive to domestic growth than the outlook for hard currency flows.[13]

- Deeper domestic financial markets improve the outlook for both hard currency and local currency flows (Figure 3.6, panel 3) and significantly limit the likelihood of negative or weak flows. The result is in line with previous studies (October 2007 GFSR) and reflects the increased market liquidity (October 2018 GFSR) and decreased volatility (discussed later in this chapter) associated with greater market depth. The probability of significant bond outflows (equivalent to the 5th percentile of historical events) declines from about 35 percent to less than 10 percent when market depth increases by one standard deviation.

[10]An exception is local currency flows during surges, which potentially reflect investor confidence in successful refinancing.

[11]A measure of downside risks to capital flows, equal to the value of flows that will materialize with 5 percent probability.

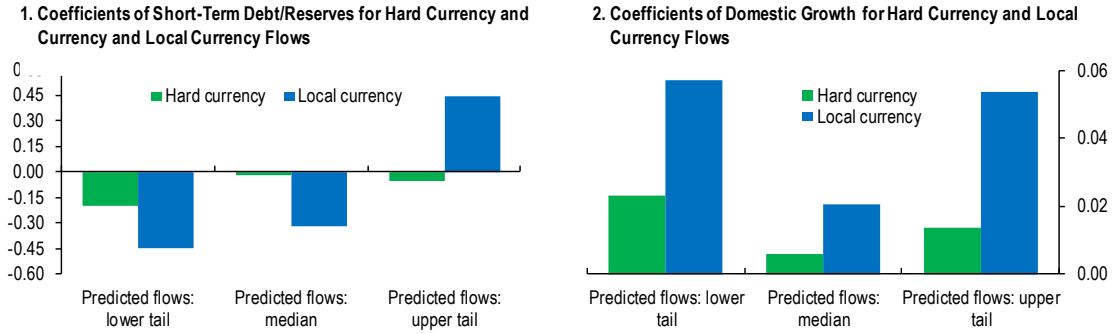
[12]This is consistent with Anderson, Silva, and Velandia-Rubiano (2010), which finds that prudent public debt management with a focus on containing risks in the debt portfolio was an additional fundamental factor that strengthened emerging markets' resilience during the global financial crisis.

[13]Greater sensitivity of local currency bonds to domestic factors provides diversification for global investors (Miyajima, Mohanty, and Chan 2012).

Figure 3.6. What Drives Local Currency versus Hard Currency Debt Portfolio Flows?

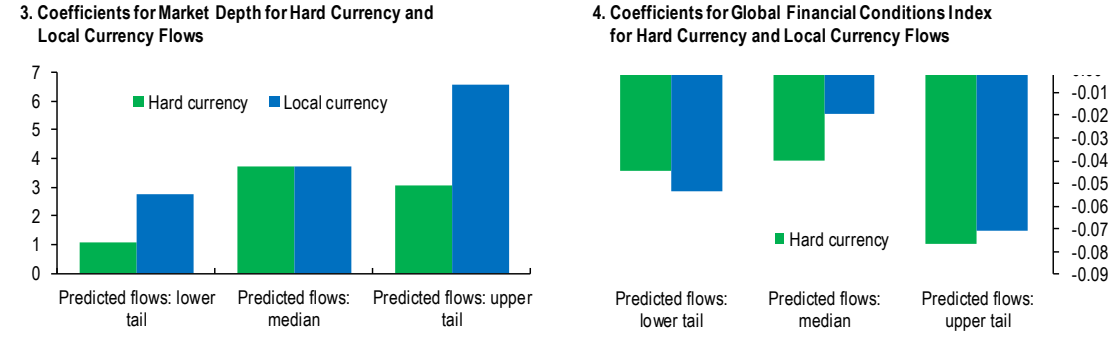
Higher short-term debt relative to reserves reduces the likelihood of negative or weak flows materially—especially for local currency flows.

Local currency flows are more sensitive to domestic growth prospects, particularly the likelihood of extreme flows.



Greater market depth significantly improves the outlook for both hard currency and local currency portfolio flows.

Tighter global financial conditions have negative effects on both local currency and hard currency flows, with a somewhat larger impact on hard currency flows.



Sources: Bloomberg Finance L.P.; Haver Analytics; JPMorgan Chase & Co; Institute of International Finance; IMF, International Financial Statistics, Financial Flows Analytics, and Assessing Reserve Adequacy databases; World Bank; and IMF staff calculations.
Note: The reported coefficients come from quantile regressions of average quarterly debt portfolio inflows in the current and next two quarters (as a percent of GDP) on a range of global and (lagged) domestic factors for a panel of emerging and frontier markets. The lower tail corresponds to average coefficients on explanatory variables from regressions for low percentiles (5th, 10th, 20th, 30th); median flows correspond to average coefficients from regressions for middle percentiles (40th, 50th, 60th); and the upper tail corresponds to average coefficients for upper percentiles (70th, 80th, 90th, 95th). See Online Annex 4.1 for details. In panel 4, the larger sensitivity of hard currency flows to global factors may reflect the attendant exchange rate volatility and its impact on the issuer's repayment capacity in the presence of foreign exchange mismatches.

20. Tighter global financial conditions decrease expected portfolio flows and have a disproportionately larger impact on the likelihood of extreme flows.[14] Moreover, hard currency flows are almost twice as sensitive as local currency flows to changes in global financial conditions (Figure 3.6, panel 4). This may in part reflect differences in the investor base—hard currency bonds are typically held by global investors—whereas the local currency bond markets are typically dominated by domestic investors.[15] For example, benchmark-driven investors have

[14]Nier, Sedik, and Mondino (2014) also finds that risk appetite becomes the dominant driver of flows during crises.

[15]Median foreign ownership of emerging market local currency bonds is just about 20 percent, though this level has risen over the past decade.

a larger presence in hard currency than in local currency sovereign debt markets (April 2019 GFSR). The analysis implies that a much weaker growth outlook for emerging markets due to the COVID-19 outbreak will significantly worsen the outlook for the local currency flows, while the outlook for hard currency flows will be relatively more affected by the sharp tightening in the global financial conditions.

Impact of Portfolio Flows on the Level and Volatility of Funding Costs

21. The pricing of sovereign debt securities is linked to country-specific fundamentals (Edwards 1985) but is also influenced by global investors' risk appetite (Eichengreen and Mody 2000). Strong domestic fundamentals help lower funding costs (Baldacci and Kumar 2010), while tight global financial conditions can widen spreads (Ebner 2009; Peiris 2010). Global risk appetite becomes especially relevant during periods of stress (González-Rozada and Levy-Yeyati 2008) because it can interact with domestic vulnerabilities to amplify the impact on borrowers, especially those with weaker fundamentals (Nickel, Rother, and Rülke 2009).

22. Foreign participation in local currency bond markets can be a mixed blessing:

- Nonresident holdings of bonds can reduce borrowing costs, currency mismatches, and rollover risks associated with external borrowing. In addition, by diversifying the investor base, issuers can increase their flexibility and boost the potential size of the market beyond the absorption capacity of their domestic investor base.
- At the same time, investment decisions by foreign investors can strengthen the link between exchange rate fluctuations and domestic financial conditions. Foreign investors can create or reinforce exchange rate pressures, and a reduction in their positions can create domestic debt rollover risks. Local currency bond outflows can also increase term premiums and increase long-term interest rates, which in turn can affect domestic activity (Carstens 2019). Ebeke and Kyobe (2015) suggests that foreign holdings transmit global financial shocks to local currency sovereign bond markets by increasing yield volatility and, beyond a certain threshold, amplifying spillovers from global shocks.

23. Depth of domestic financial markets can help countries mobilize savings, promote information sharing, and diversify risk. Deep financial systems can also support financial stability by helping buffer the economy against external shocks and by dampening the volatility of asset prices (Sahay and others 2015).[16]

[16]Sahay and others (2015) also points out a potentially dark side of financial deepening in terms of financial stability; that is, a "too much finance effect."

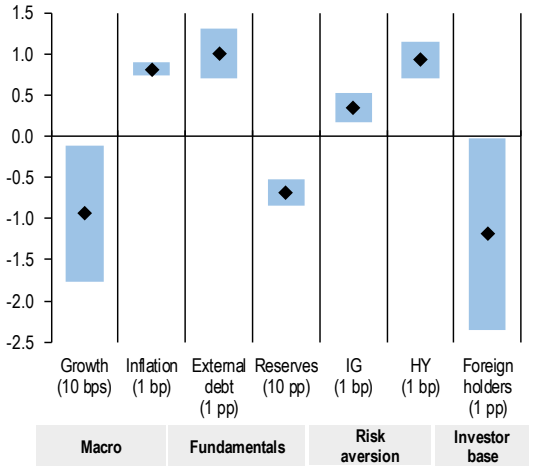
Level of Funding Costs

24. Stronger domestic fundamentals are associated with lower funding costs (Figure 3.7, panel 1).[17] High inflation increases local currency bond yields, while better growth prospects contribute to lower yields. Elevated vulnerabilities and lower buffers tend to increase the cost of funding: higher levels of external debt and lower levels of foreign exchange reserves are associated with higher local currency yields. IMF staff analysis suggests that the sensitivity of local currency bond yields to the level of foreign exchange reserves has increased in recent years, while sensitivity to external debt appears to have declined somewhat as the search for yield has intensified (Figure 3.7, panel 2).[18]

Figure 3.7. Emerging Market Local Currency Bond Yields

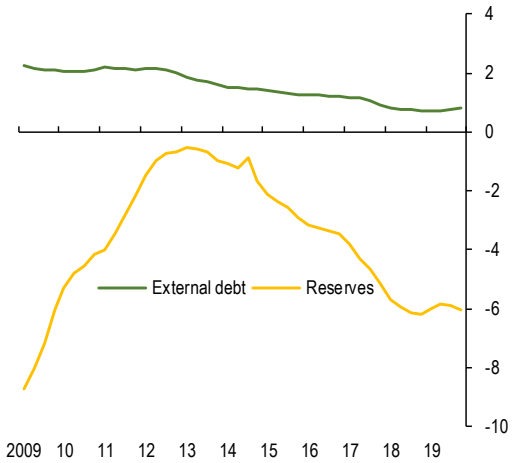
Funding cost is lowered by stronger domestic fundamentals and higher foreign participation.

1. Sensitivity to Global and Domestic Factors
(Scaled coefficients; blue bars are the two standard deviation error hands; black dots are the coefficients)



Local currency bond yields have become more sensitive to reserve adequacy and less sensitive to the level of external debt.

2. Sensitivity of Local Currency Yields to Reserves/GDP and External Debt/Exports
(Coefficient, rolling 24-quarter regression)



Sources: Bloomberg Finance L.P.; Haver Analytics; JPMorgan Chase & Co; Institute of International Finance; and IMF staff calculations.
Note: Panels 1 and 2 report the unconditional effect of domestic and global factors on the local currency bond yields. In panel 1, variable coefficients are scaled by a given metric; for example, for every 10 basis point increase in growth, yields change by -0.9 basis points as per the panel. For every 1 percentage point increase in external debt (to exports), yields change by 1 percentage point. bp = basis point; HY = high yield; IG = investment-grade; pp

25. Lower-rated bond issuers are found to be more vulnerable to swings in global investor risk sentiment than higher-rated issuers,[19] as suggested by analysis of yield sensitivity to global risk-aversion shocks (Figure 3.7, panel 1). For example, a 100 basis point increase in US BBB-

[17]See Baldacci and Kumar (2010), Jaramillo and Weber (2013), and Piljak (2013).

[18]This might also reflect the lengthening of maturities by investors.

[19]The results are consistent with the hard currency spread analysis conducted in the October 2019 GFSR.

rated corporate spreads could widen yields of high-yield emerging market bonds by almost 100 basis points, compared with only 40 basis points for investment-grade issuers.

26. Greater foreign participation also helps reduce local currency yields (as in Ebeke and Lu 2015), which reflects the investor confidence channel as well as the role of foreign investors in the development of local bond markets (Peiris 2010).

27. Credit ratings also play an important role in determining funding costs (Jaramillo and Tejada 2011), even after accounting for fundamentals, as they alter investor behavior and eligibility. Local currency debt has been deemed safer by sovereign debt managers (Amstad, Packer, and Shek 2018), and this has aided the push toward greater local currency borrowing.[20] However, the ratings gap between local and foreign currency debt has narrowed significantly over time, as the local currency rating advantage has withered away. For 80 percent of the countries in the sample, there is currently no difference between the local and foreign currency rating, compared with 50 percent at the time of the global financial crisis and 20 percent during the Asian financial crisis (Figure 3.8, panels 1 and 2). This convergence has been driven by a worsening of local currency ratings.[21]

28. There are also notable differences between hard and local currency debt in terms of drivers of their valuations.[22] Hard currency bond spreads, especially for high-yield issuers, are affected about 60 percent more by global risk aversion shocks (Figure 3.9, panel 1). Local currency spreads are more sensitive to domestic vulnerabilities, including external debt and reserve adequacy (Figure 3.9, panel 2).[23] Economic fundamentals have a mixed effect, with domestic inflation disproportionately increasing local currency spreads (Figure 3.9, panel 3). Every percentage point rise in inflation increases local currency bond spreads by more than 70 basis points, but by only 20 basis points for hard currency bond spreads, and GDP growth has a greater impact on hard currency bond spreads.

[20]Led by China's domestic bond market boom (Dehn 2019), local currency bonds now account for almost 90 percent of the marketable emerging market fixed-income universe compared with 75 percent in 2008.

[21]This reflects country-level downgrades (Brazil, South Africa, Turkey) and increased recognition that sovereigns do default in local currency (Reinhart and Rogoff 2009), as well as more local currency ratings, possibly for the lower-rated countries (Amstad, Packer, and Shek 2018).

[22]These spreads capture only part of the funding costs. The level of local currency yields can also be affected by monetary policy.

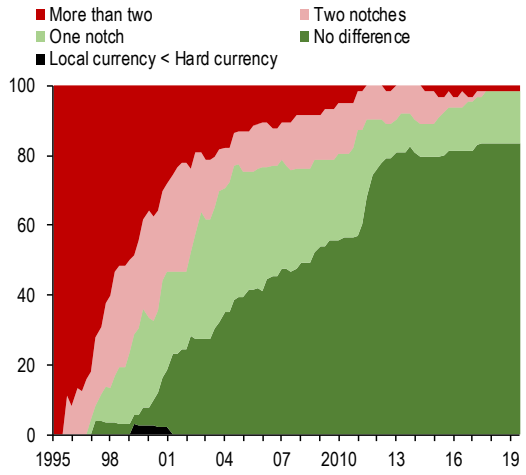
[23]Du and Schreger (2013) also finds that local currency bond spreads are less sensitive to global factors than hard currency bond spreads.

Figure 3.8. Local Currency versus Hard Currency Sovereign Ratings

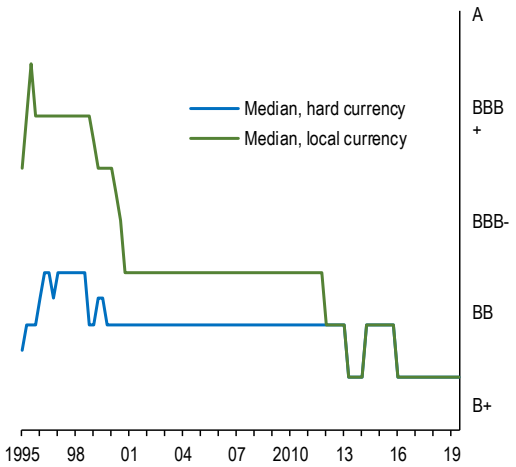
The local currency ratings advantage has narrowed significantly over time …

… driven by an overall worsening of ratings.

1. Distribution of the Difference between Local and Foreign Ratings (Percent)



2. Median Local Currency versus Foreign Currency Rating



Sources: Bloomberg Finance L.P.; and S&P Capital IQ.
Note: Panels reflect S&P sovereign credit ratings.

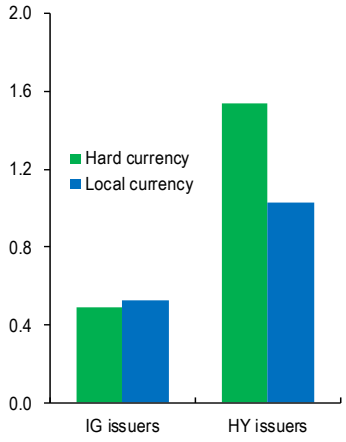
Figure 3.9. Drivers of Hard Currency versus Local Currency Spreads

External spreads are more affected by shocks in global risk aversion.

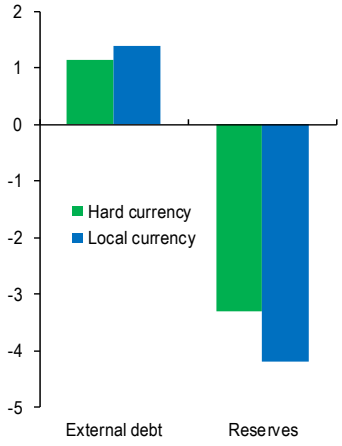
Local currency spreads are more affected by domestic vulnerabilities and

GDP growth has a greater impact on hard currency bond spreads.

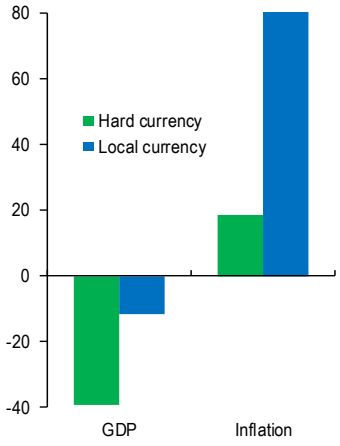
1. Sensitivity of Hard Currency and Local Currency Spreads to the Global Risk Appetite Proxy (Coefficient)



2. Sensitivity of Hard Currency and Local Currency Spreads to External Debt and Reserves (Coefficient))



3. Sensitivity of Hard Currency and Local Currency Spreads to Country Growth and Inflation (Coefficient)



Sources: Bloomberg Finance L.P.; Haver Analytics; JPMorgan Chase & Co; Institute of International Finance; and IMF staff calculations.
Note: Spreads on local currency bonds are proxied by subtracting the five-year US Treasury yield from the local currency yields. The specification for local currency spreads is the same as discussed for local currency yields in the previous section and described in Online Annex 4.1. The model for the hard currency spreads is the same as introduced in the October 2019 Global Financial Stability Report. HY = high yield; IG = investment-grade.

Volatility of Funding Costs

29. IMF staff analysis finds evidence that greater foreign participation in local currency bond markets increases the volatility of yields after it reaches a certain threshold, while further domestic financial deepening helps reduce the volatility of yields. In particular, conditional on domestic factors, when the size of foreign investor bond holdings exceeds about 40 percent of the country's international reserves, the volatility of yields is found to increase by about 15 percent (see Table 3.1 and Online Annex 3.1). Controlling for the same factors and the threshold effect for foreign participation, the analysis finds that domestic financial market deepening decreases volatility significantly.[24] On average, domestic financial market deepening helped emerging market economies dampen volatility by 39 percent during 2004–17.

Table 3.1. Contribution of Financial Market Depth and Foreign Participation to the Volatility of Yields

Estimates show that financial market depth increases volatility when foreign participation rises beyond a 40 percent threshold.

Variable Threshold (Percent)	Financial Market Depth	Dummy: Foreign Participation
37	-1.051***	0.009
38	-1.029***	0.060
39	-1.015***	0.090
40	-0.980***	0.147**
41	-0.969***	0.163**
42	-0.967***	0.205***
43	-0.980***	0.188**

Source: IMF staff calculations.
Note: The is based on quarterly data from 18 emerging market economies during 2004–17. The number of observations is 741. Country and quarter fixed effects are included. The dependent variable is volatility of yield. The dummy is defined using the ratio of different thresholds of foreign participation in local currency bond markets to reserves. Control variables are the ratio of the lagged value of foreign participation to reserves; and the current account balance, external debt, government debt, inflation, reserves, exchange rate against the US dollar, and turnover in the foreign exchange market. Results are robust to dropping these control variables and are not driven by any of the countries in the sample. Results are very similar for the depth of financial institutions (see Online Annex 4.1).
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Foreign Investor Participation in Frontier Markets and Debt Rollover Risks

30. Strong investor interest in frontier market economies in 2017–19 led to a notable increase in nonresident exposures in the foreign exchange and local currency bond markets. Local currency bond markets in Egypt and Nigeria have consistently had some of the largest overweight exposures in investor surveys, with most of the foreign holdings concentrated in their high-yielding short-term debt market segments. As a result, the share of foreign holdings of local currency debt in several frontier markets reached levels similar to those prevalent in

[24]The variable used for financial market deepening does not capture all aspects of market depth—for example, the amount of foreign exchange liquidity, which could also act as a mitigating factor (as in Mexico and South Africa), is not accounted for.

emerging markets, despite the relatively weaker fundamentals and policy frameworks in frontier market economies (Figure 3.10, panel 1). Evidence so far from the COVID-19–induced market turbulence suggests that economies with greater nonresident investor participation in domestic bond markets experienced larger yield increases (Hofmann, Shim, and Shin 2020) and higher exchange rate volatility. Frontier markets underperformed, experiencing large outflows[25] and acute exchange rate pressure, with 12-month nondeliverable forwards depreciating by more than 20 percent in some cases (Figure 3.10, panel 2).

31. Frontier market economies often lack financial depth and have a relatively shallow domestic investor base.[26] Many of them rank well below the emerging market median in terms of overall financial development and the depth of local financial markets (Figure 3.10, panel 3). The lack of financial depth is also reflected in more challenging local market liquidity conditions, with bid-offer spreads and the price impact of trades typically being much larger than in other emerging markets (Figure 3.10, panel 4). Limited market liquidity tends to compound market pressures in times of stress due to reduced capacity of market makers to intermediate flows, and may also impair the monetary policy transmission, especially in countries where foreigners are concentrated in short-term instruments.

32. Emerging signs of financing strains, combined with a greater need for debt issuance to support the COVID-19–related fiscal spending and a difficult external demand outlook (most notably, for oil and tourism revenues), pose significant risks for frontier market economies. Short-term relief from debt payments to official creditors announced by the IMF, the World Bank, and the G20 in April 2020 provides vulnerable economies with some breathing room to handle the health emergency. But over the near-term, many frontier market economies may need to rethink the currency composition of their debt issuance, the extent of reliance on official versus private creditors and the extent of foreign investor participation in their local markets.

33. Over the long-term, beyond the COVID-19 pandemic, frontier market economies should seek to develop their local financial markets where feasible. The empirical estimates based on the analysis in this chapter suggest that a further deepening of domestic financial markets and institutions to the emerging market average level could help an average frontier market economy lower the volatility of its local currency bond yield by almost 30 percent. The capital-flows-at-risk analysis also suggests that if frontier market economies were to increase their financial depth to the emerging market average level, their portfolio debt flow outlook could improve by 1.2 percent of GDP, on average, and the probability of net nonresident outflows could decline by 15 percentage points.

---

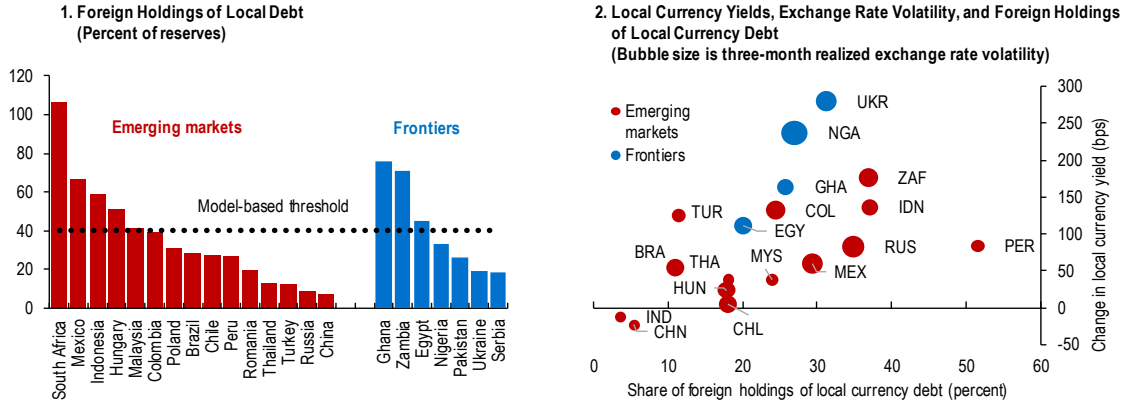
[25]For example, there were reports of large outflows in local currency debt and/or reserves declines in Egypt and Nigeria.

[26]In addition, none of the countries in the frontier market sample are yet included in any of the major global index or emerging market bond indices. In comparison, several emerging market local currency bond markets are part of both global and emerging market types of indices (for example, Malaysia, Mexico, Poland, South Africa), which can help them attract more buy-and-hold foreign investors.

Figure 3.10. Local Currency Debt Markets

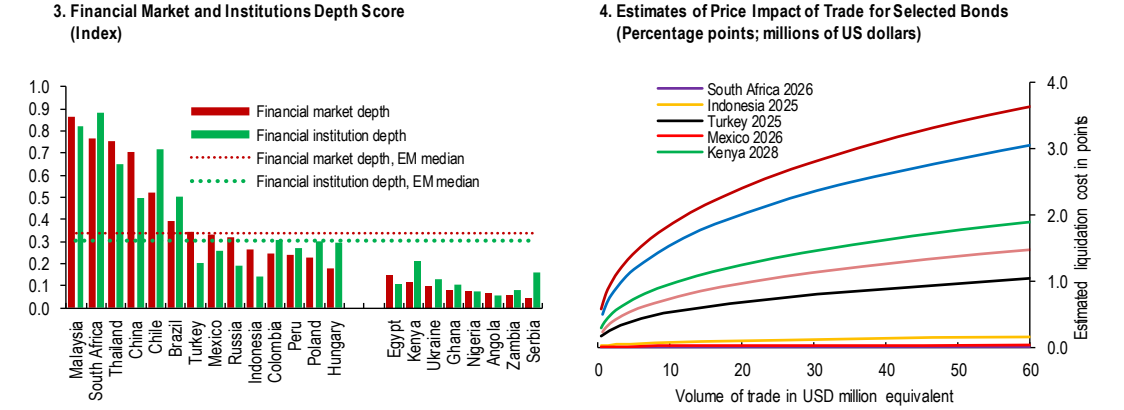
Foreign participation in local currencybond markets is comparable between emerging and frontier market economies.

Generally, countries with larger share of nonresident investors in their local markets saw a larger increase in their bond yields.



A shallower domestic investor base and lower financial depth have the potential to create higher volatility ...

... and limited liquidity can augment market volatility.



Sources: JP Morgan Chase & Co.; and IMF staff calculations.
Note: Panel 1 and 2 holdings data are latest available as ofof the end of February - 2020. Reserve data are end-2019 estimates as of the end of 2019. For Nigeria and Egypt, only T-bill holdings are considered. Panel 2 exchange rate volatility for frontiers is calculated using non deliverable forwards. The panel 3 index is calculated based on latest available data as of 2017. Panel 4 estimates use the liquidity assessment function in Bloomberg as of January 2019. In panel 2, data labels use International Organization for Standardization (ISO) country codes. bps = basis points.

Policy Priorities

34. The analysis presented in this chapter focuses on the cost-risk considerations related to different types of portfolio flows that have a bearing on sovereign debt management, capital flow management, exchange rate, and macroprudential policies. These policies can play an important role in containing external pressures and help cushion the corresponding macroeconomic and financial impacts that emerging markets are facing during the COVID-19 crisis.

What should policymakers do now?

35. The specific policy responses to external pressures will depend on the nature of the shock (for example, liquidity versus solvency crisis), fiscal and monetary policy space, depth of financial markets and balance sheet vulnerabilities, among others (see Chapter 1 for a broader discussion

of policy priorities). However, there are some common principles that can help guide policy choices:

Foreign currency interventions

- For countries with flexible exchange rates, credible monetary frameworks, low inflation, deep financial markets, and the absence of large currency mismatches, the exchange rate should be a key shock absorber.
- For countries with adequate reserves, exchange rate intervention can lean against market illiquidity and thus play a role in muting excessive volatility. However, interventions should not prevent necessary adjustments of the exchange rate. Interventions should be planned on the basis that the pressures arising from the current crisis might last several months or longer.
- Countries with fixed or tightly managed currency regimes, including some major oil exporters and frontier markets, have more difficult trade-offs to consider. If reserves are adequate, maintaining the currency regime may be the best course of action in the short term. Exchange rate intervention, however, may need to be supported by monetary policy tightening and possibly capital flows management measures. These policies should also be planned on the basis that the outflow pressures may last several months or longer, which may put current currency regimes under severe strain.

Capital flow management measures

- In the face of an imminent crisis, introducing outflow capital flow management measures could be part of a broad policy package, but these measures cannot substitute for, or avoid, warranted macroeconomic adjustment. If nonresident outflows are a significant driver of overall outflows, minimum holding periods, caps and other limitations on nonresidents' transfers abroad could be considered with due regard to the country's international obligations. Such measures should be implemented in a transparent manner, be temporary, and lifted once crisis conditions abate.

Sovereign debt management strategy

- Sovereign debt managers should prepare for long-term external funding disruptions. Countries that still enjoy market access at reasonable rates should actively decrease rollover risks as part of their debt management strategy. From the perspective of the trade-off between cost and risk, lowering rollover risks should take priority over concerns about containing costs when there are large downside risks stemming from potential loss of market access. Given the large sensitivity of the private sector and some state-owned enterprises to commodity prices, sovereign debt managers should consider the interactions between the government's financing strategy and other domestic issuers in times of stress to ensure that debt management activities of the government do not
- exacerbate risks (IMF 2014).

Macroprudential policy

- If macroprudential buffers exist, a relaxation of these tools can reduce the impact of the current shock in market conditions as well as to the general economy. For example, foreign currency reserve requirements can be relaxed to mitigate foreign exchange funding pressures. Furthermore, countries that have introduced additional liquidity coverage ratio requirements in foreign currency can allow banks to use the buffer, or relax the requirement.

Looking beyond the current crisis

36. For frontier market economies with less developed financial systems, *local capital market development* and the promotion of a stable and diversified local investor base should be a priority. This would require coordination among public stakeholders and proper sequencing of reforms (IMF 2020). Specific measures include (1) developing efficient money markets, (2) strengthening primary market practices to enhance transparency and predictability of issuance, (3) bolstering market liquidity, (4) developing a robust market infrastructure, and (5) establishing a sound legal and regulatory framework for securities.

37. During periods of strong investor appetite, *macroprudential tools* may be put in place or tightened preemptively—before an inflow surge occurs—and maintained over the long term or permanently to build resilience and/or contain the buildup of systemic financial risk. Policymakers should weigh all evidence about encouraging the participation of foreign investors beyond a level considered prudent after taking into account the capacity of their local markets to absorb external shocks without excessive volatility. In particular, in cases where local markets are at an early stage of development and the room for adjusting macroeconomic policies is limited, authorities should proceed with caution with liberalizing portfolio inflows. Countries with portfolio flow restrictions that intend to liberalize might consider a gradual approach by moving toward either quantitative limits or price-based restrictions (for example, taxes, reserve requirements) that could mitigate risks of excessive inflows.

References

Adrian, Tobias, Nina Boyarchenko, and Domenico Giannone. 2019. "Vulnerable Growth." *American Economic Review* 109 (4): 1263–289.

Alam, Zohair, Adrian Alter, Jesse Eiseman, Gaston Gelos, Heedon Kang, Machiko Narita, Erlend Nier, and Naixi Wang. 2019. "Digging Deeper—Evidence on the Effects of Macroprudential Policies from a New Database." IMF Working Paper 19/66, International Monetary Fund, Washington, DC.

Alfaro, Laura, Sebnem Kalemli-Ozcan, and Vadym Volosovych. 2008. "Why Doesn't Capital Flow from Rich to Poor Countries? An Empirical Investigation." *Review of Economics and Statistics* 90 (2): 347–68.

Amstad, Marlene, Frank Packer, and Jimmy Shek. 2018. "Does Sovereign Risk in Local and Foreign Currency Differ?" BIS Working Paper 709, Bank for International Settlements, Basel.

Anderson, Phillip, Anderson Caputo Silva, and Antonio Velandia-Rubiano. 2010. "Public Debt Management in Emerging Market Economies: Has This Time Been Different?" Policy Research Working Paper 5399, World Bank, Washington, DC.

Baldacci, Emanuele, and Manmohan Kumar. 2010. "Fiscal Deficits, Public Debt and Sovereign Bond Yields." IMF Working Paper 10/184, International Monetary Fund, Washington, DC.

Brandao-Marques, Luis, Gaston Gelos, Machiko Narita, and Erlend Nier. Forthcoming. "Leaning against the Wind: An Empirical Cost-Benefit Analysis." IMF Working Paper, International Monetary Fund, Washington, DC.

Carstens, Agustín. 2019. "Exchange Rates and Monetary Policy Frameworks in Emerging Market Economies." Lecture at the London School of Economics, May 2.

Calvo, Guillermo A., and Carmen Reinhart. 1999. "When Capital Flows Come to a Sudden Stop: Consequences and Policy Options." Working Paper, University of Maryland, College Park, MD.

Cecchetti, Stephen, Tommaso Mancini-Griffoli, Machiko Narita, and Ratna Sahay. 2020. "US or Domestic Monetary Policy: Which Matters More for Financial Stability?" *IMF Economic Review* 68: 35–65.

———. Forthcoming. "International Spillovers of 'Lower for Longer'—US Interest Rates: Can They Be Mitigated?"

Cizel, Janko, Jon Frost, Aerdt Houben, and Peter Wierts. 2016. "Effective Macroprudential Policy: Cross-Sector Substitution from Price and Quantity Measures." IMF Working Paper 16/94, International Monetary Fund, Washington, DC.

Dehn, Jan. 2019. "The EM Fixed Income Universe Version 8.0." *The Emerging View* (August), Ashmore Investment Management Ltd.

Du, Wenxin, and Jesse Schreger. 2013. "Local Currency Sovereign Risk." International Finance Discussion Paper 1094, Board of Governors of the Federal Reserve System, Washington, DC.

Ebeke, Christian Hubert, and Annette Kyobe. 2015. "Global Financial Spillovers to Emerging Market Sovereign Bond Markets." IMF Working Paper 15/141, International Monetary Fund, Washington, DC.

Ebeke, Christian Hubert, and Yinqiu Lu. 2015. "Emerging Market Local Currency Bond Yields and Foreign Holdings—A Fortune or Misfortune?" *Journal of International Money and Finance*, Elsevier, 59 (C), 203–19.

Ebner, André. 2009. "An Empirical Analysis on the Determinants of CEE Government Bond Spreads." *Emerging Markets Review* 10 (2): 97–121.

Edwards, Sebastian. 1985. "The Pricing of Bonds and Bank Loans in International Markets: An Empirical Analysis of Developing Countries' Foreign Borrowing." NBER Working Paper 1689, National Bureau of Economic Research, Cambridge, MA.

Eichengreen, Barry, and Ashoka Mody. 2000. "What Explains Changing Spreads on Emerging Market Debt?" In *Capital Flows and the Emerging Economies: Theory, Evidence, and Controversies*, edited by Sebastian Edwards. Chicago: University of Chicago Press for the National Bureau of Economic Research.

Fendoğlu, Salih. 2017. "Credit Cycles and Capital Flows: Effectiveness of the Macroprudential Policy Framework in Emerging Market Economies." Journal of Banking & Finance 79 (June): 110–28. https://doi.org/10.1016/j.jbankfin.2017.03.008.

Forbes, Kristin J. 2019. "Macroprudential Policy: What We've Learned, Don't Know, and Need to Do." *AEA Papers and Proceedings* 109 (May): 470–75.

Gelos, Gaston, Lucyna Górnicka, Robin Koepke, Ratna Sahay, and Silvia Sgherri. 2019. "Capital Flows at Risk: Taming Ebbs and Flows." IMF Working Paper 19/279, International Monetary Fund, Washington, DC.

González-Rozada, Martín, and Eduardo Levy-Yeyati. 2008. "Global Factors and Emerging Market Spreads." *Economic Journal* 118 (533): 1917–936.

Group of Twenty (G20). 2020. "Staff Note for the G20 International Financial Architecture Working Group (IFAWG): Recent Development on Local Currency Bond Markets in Emerging Economies." International Monetary Fund–World Bank, Washington, DC.

Guidotti, Pablo, Federico Sturzenegger, and Agustín Villar. 2004. "On the Consequences of Sudden Stops." *Economía* 4 (2): 171–214.

Hannan, Swarnali. 2018. "Revisiting the Determinants of Capital Flows to Emerging Markets: A Survey of the Evolving Literature." IMF Working Paper 18/214, International Monetary Fund, Washington, DC.

Hofmann, Boris, Ilhyock Shim, and Hyun Song Shin. 2020. "Emerging Market Economy Exchange Rates and Local Currency Bond Markets amid the Covid-19 Pandemic." BIS

Bulletin, Bank for International Settlements, Basel.

International Monetary Fund (IMF). 2013. "Revised Guidelines for Foreign Exchange Reserve Management." IMF Policy Paper, Washington, DC.

_____. 2014. "Revised Guidelines for Public Debt Management." IMF Policy Paper, Washington, DC.

_____. 2017. "Increasing Resilience to Large and Volatile Capital Flows—The Role of Macroprudential Policies." IMF Policy Paper, Washington, DC.

_____. 2018. "The IMF's Institutional View on Capital Flows in Practice." Washington, DC. https://www.imf.org/external/np/g20/pdf/2018/073018.pdf.

_____. 2020. "Guidance Note on Developing Government Local Currency Bond Market." Washington, DC.

Jaramillo, Laura, and Catalina Michelle Tejada. 2011. "Sovereign Credit Ratings and Spreads in Emerging Markets: Does Investment Grade Matter?" IMF Working Paper 11/44, International Monetary Fund, Washington, DC.

Jaramillo, Laura, and A. Weber. 2013. "Bond Yields in Emerging Economies: It Matters What State You Are In." *Emerging Markets Review* 17:169–85.

Koepke, Robin. 2019. "What Drives Capital Flows to Emerging Markets? A Survey of the Empirical Literature." *Journal of Economic Surveys* 33 (2): 516–40.

Krugman, Paul. 1999. "Balance Sheets, the Transfer Problem, and Financial Crises." *International Tax and Public Finance* 6: 459–72.

Li, Suxiao, Jakob de Haan, and Bert Scholtens. 2018. "Are International Fund Flows Related to Exchange Rate Dynamics?" *Open Economies Review* 29: 31–48 https://doi.org/10.1007/s11079-_017-9469-5.

Milesi-Ferretti, Gian-Maria, and Cédric Tille. 2010. "The Great Retrenchment: International Capital Flows during the Global Financial Crisis." IHEID Working Paper 18–2010, Economics Section, Graduate Institute of International and Developmental Studies, Geneva (revised September 15).

Miyajima, Ken, Madhusudan Mohanty, and Tracy Chan. 2012. "Emerging Market Local Currency Bonds: Diversification and Stability." BIS Working Paper 391, Bank for International Settlements, Basel.

Nickel, Christiane, Philipp C. Rother, and Jan-Christope Rülke. 2009. "Fiscal Variables and Bond Spreads: Evidence from Eastern European Countries and Turkey." ECB Working Paper 1101, European Central Bank, Frankfurt.

Nier, Erlend, Tahsin Saadi Sedik and Tomas Mondino. 2014. "Gross Private Capital Flows to Emerging Markets: Can the Global Financial Cycle Be Tamed." IMF Working Paper 14/196, International Monetary Fund, Washington, DC.

Nier, Erlend Walter, Thorvardur Tjoervi Olafsson, and Yuan Gao Rollinson. Forthcoming.

"Exchange Rates, Domestic Credit, and Macroprudential Policy." IMF Working Paper, International Monetary Fund, Washington, DC.

Peiris, Shanaka. 2010. "Foreign Participation in Emerging Markets' Local Currency Bond Markets." IMF Working Paper 10/88, International Monetary Fund, Washington, DC.

Piljak, Vanja. 2013. "Bond Markets Co-Movement Dynamics and Macroeconomic Factors: Evidence from Emerging and Frontier Markets." Emerging Markets Review 17: 29–43.

Reinhart, Carmen M., and Kenneth S. Rogoff. 2009. "The Aftermath of Financial Crises." American Economic Review, 99 (2): 466-72.

Sahay, Ratna, Martin Čihák, Papa N'Diaye, Adolfo Barajas, Ran Bi, Diana Ayala, Yuan Gao, Annette Kyobe, Lam Nguyen, Christian Saborowski, Katsiaryna Svirydzenka, and Seyed Reza Yousefi. 2015. "Rethinking Financial Deepening: Stability and Growth in Emerging Markets." IMF Staff Discussion Note 15/08. International Monetary Fund, Washington, DC.

ONLINE ANNEX 3.1. TECHNICAL NOTE[1]

1. Capital-Flows-at-Risk[2]

1. While the past literature on the drivers of capital flows focused primarily on the contemporaneous relationship between capital flows and different factors, the Capital-Flows-at-Risk framework takes a forward-looking perspective on risks to capital flows by asking what global and domestic conditions today can tell us about the probability and the size of future capital flows. The approach applies quantile regressions to compute the entire probability distribution of future flows and considers the joint impact of different drivers on the predicted distribution. The risks to future flows are measured by the size (and changes) in the tails of the distribution.

2. The approach is similar in spirit to the Growth-at-Risk analysis, published in the Global Financial Stability Report before (IMF 2017 and 2018; see also Adrian et al. 2018). Since then it has been applied to capital flows for example in IMF (2018) and in Gelos et al. (2019). The methodology builds on the analysis in Gelos et al. (2019) and extends it to various types of portfolio flows.

Empirical Approach

3. Let $\bar{y}_{i,t:t+h}$ denote the average portfolio inflows to country i (in percent of GDP) in the quarters t,t+1,…t+h, where t stands for current quarter. Our baseline regression is specified as follows:

$$\bar{y}^{\alpha}_{i,t:t+h} = \gamma^{\alpha}_{i} + \beta^{\alpha}_{1} Global_t + \beta^{\alpha}_{2} Domestic_{i,t-1} + \beta^{\alpha}_{3} TimeControls, \quad (1)$$

for α=0.05, 0.1, 0.15, …,0.95.

4. $Global_t$ is a vector of global "push" factors, $Domestic_{i,t}$ stands for country-specific factors in country i at time t-1, that have been considered as "pull" drivers in the literature. All domestic variables are lagged to limit potential for reverse causality. All regressions also include dummies for the pre-GFC, GFC, and post-GFC periods and country fixed effects.

[1] This is an annex to Chapter 3 of the April 2020 *Global Financial Stability Report.*

[2] This section was prepared by Rohit Goel and Lucyna Górnicka.

5. The upper-script α stands for the percentile at which the regression is estimated. In a general quantile regression of a variable $\bar{y}_{t:t+h}$ on a vector of controls x_t , $\bar{y}_{t:t+h} = \delta^{\alpha} x_t$, the regression slope δ^{α} is chosen to minimize the quantile-weighted absolute value of errors:

$$\hat{\delta}^{\alpha} = \text{argmin} \sum_{t=1}^{T-h} (\alpha \times 1_{\bar{y}_{t:t+h} > x_t \delta} |\bar{y}_{t:t+h} - x_t \delta| + (1-\alpha) \times 1_{\bar{y}_{t:t+h} < x_t \delta} |\bar{y}_{t:t+h} - x_t \delta|) \quad (2)$$

where $1_{(\cdot)}$ denotes the indicator function. The predicted value from that regression is the percentile of $\bar{y}_{t:t+h}$ conditional on x_t. In this application, equation (1) is estimated for a range of percentiles from the 5th to the 95th percentile. Estimates are then used for a range of percentiles to construct an empirical distribution of predicted average portfolio flows.

6. To summarize the information from individual quantile regressions, the analysis distinguishes between the lower tail of the predicted distribution, median predicted flows and the upper tail of the distribution:[3] the average of coefficients from regressions for the 5th to 30th percentiles reflects impact of a variable on the *lower tail* of the conditional predicted distribution of future flows, the average of coefficients from regressions for the 40th to 60th percentiles—on *median flows,* and the average of coefficients from the regression for the 70th to 95th percentiles—on *upper tail* of the distribution.

7. Finally, in the Capital-Flows-at-Risk framework, risks to capital flows can be quantified by estimating the *size of outflows* that would be reached or exceeded for a given probability. This amount is called "capital flows at risk" (CaR), and—following the Growth-at-Risk literature—it is estimated it using the 5th percentile of the distribution.

Variants of the Model and Sample Description

8. The analysis considers different types of portfolio flows:

- *Total debt portfolio flows*. This part focuses on the drivers of aggregate debt portfolio flows, independently of the currency in which debt flows are denominated, and it is based on a sample of 37 emerging market economies (Online Annex Table 3.1.1).

- *Total debt portfolio flows versus equity portfolio flows*. Next, the drivers of debt flows and equity flows are analyzed based on a sample of the 18 emerging market economies with sufficiently liquid equity markets (Online Annex Table 3.1.1).

- *Local currency debt flows versus hard currency debt flows*. The analysis is based on a sample of 15 large economies for which sufficiently long data on local currency debt flows are

[3] The overall results hold true even when only the coefficients of the extreme quantiles are considered; but averaging across quantiles gets an approximation of the shape of the distribution

available. Hard currency debt flows are calculated as the residual from the overall portfolio debt flows (Online Annex Table 3.1.1).

Online Annex Table 3.1.1. Sample Characteristics

	Total Debt Portfolio Flows	Debt versus Equity Portfolio Flows	Local Currency versus Hard Currency Debt Portfolio Flows
EMEA Region	Bulgaria, Bosnia and Herzegovina, Belarus, Georgia, Hungary, Kazakhstan, North Macedonia, Poland, Romania, Russia, Serbia, Ukraine, Egypt, Morocco, Turkey, South Africa, Jordan, and Mauritius	Bulgaria, Hungary, Poland, Romania, Russia, Egypt, Turkey, and South Africa	Egypt, Hungary, Poland, Russia, Turkey, Ukraine, and South Africa
Asia and Pacific Region	India, Indonesia, Republic of Korea, Malaysia, Philippines, and Thailand	India, Indonesia, Republic of Korea, Malaysia, Philippines, and Thailand	China, India, Indonesia, Korea, and Malaysia
Central and South America Region	Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Guatemala, Jamaica, Mexico, Panama, Peru, El Salvador, Paraguay, and Uruguay	Brazil, Chile, Colombia, Mexico, and Peru	Brazil, Mexico, and Peru
Time Period	1996:Q4–2019:Q1	1996:Q4–2019:Q1	2000:Q1–2019:Q1
Panel Type	Unbalanced	Unbalanced	Unbalanced

Sources: Country Sources; Haver Analytics; IMF Financial Flows Analytics database; and IMF staff calculations.

Variables Description

9. In each specification, the dependent variable is gross portfolio inflows, i.e., net non-resident purchases of EM debt instruments. Portfolio flows data are measured in US dollars, scaled by GDP in US dollars.[4] The time horizon is a total of three quarters—including the current quarter and two quarters ahead.

10. The independent variables capture the various external and domestic drivers ("push and pull" factors) that have been established in the capital flows literature.[5] In our preferred specification, push factors include:[6]

1) the VIX index, as a proxy for the global risk appetite,
2) market interest rates captured through the U.S. 10-year Treasury yields,[7] and
3) the U.S. dollar (measured by the DXY dollar index).

[4] China is excluded from this analysis because of its unique country characteristics, including its size relative to the rest of EMs.

[5] The specification broadly mirrors the work done in Gelos et al. 2019, where a broad range of additional explanatory variables were also tested.

[6] For the hard currency vs local currency capital flows at risk analysis, variables #7 and #8 are not included given the constraints on the degrees of freedom and the smaller sample size.

[7] In the empirical literature, the change in US 10-year Treasury yields is commonly used to analyze the determinants of capital flows. The predictive content for *future* capital flows, however, is better captured by the *level* of 10-year yields. The 10-year yield is de-trended using a Hodrick-Prescott filter to remove the secular downward trend observed over the past 35 years. The de-trended variable can be interpreted as a cyclical measure of US interest rates, with yields generally rising during economic expansions and falling during contractions.

11. A specification where the three push factors are replaced with a global financial conditions (FCI) index is considered. On the domestic side, the variables are:

4) a ratio of short-term external debt foreign reserves, as a proxy for external balance sheet vulnerabilities,
5) year-on-year real GDP growth rate,
6) financial market depth index, capturing the level of development and liquidity of the domestic financial markets,
7) capital account openness, measuring the severity of restrictions on cross-border capital transactions, and
8) GDP growth per capita, a measure of economic development and domestic wealth.[8]

Data Sources

12. The data on debt and equity portfolio inflows are from the IMF's Financial Flow Analytics database. The time series of VIX, U.S. 10-year treasury yields and the DXY index come from the St. Luis Fed database. The GDP growth rates, short-term external debt to reserves ratio, financial market depth index and the global financial conditions index all come from the IMF (see Svirydzenka 2016 for a description of the financial market depth index). The Chinn-Ito index is used as a measure of capital account openness. GDP per capita figures are sourced from the World Bank and the local currency capital flows are from Haver Analytics and country sources. Hard currency capital flow data is then approximated as a residual from the BoP Portfolio Debt Flows.

Results

13. *Aggregate debt portfolio flows and debt portfolio flows versus equity portfolio flows (*Figure 3.6*).* Panels 1 and 2 of Figure 3.6 show the average coefficients from the subsets of quantile regressions based on the sample of 37 countries. Panels 3–6 show the average coefficients from regressions for debt and for equity portfolio flows, based on a smaller sample of 18 economies, for which a meaningful comparison of the two types of portfolio flows was possible. The absolute values of coefficients are reported in all the panels, but the results regarding debt versus equity portfolio flows also hold when looking at the standardized coefficients—reported in Online Annex Figure 3.1, panel 1.

14. Panel 1 reports average coefficients on the global FCI index when only the global FCI is included as a measure of global factors in equation (1). All other panels in Figure 3.5 present results from regressions that include the VIX index, the DXY index, and the U.S. 10-year

[8] In principle, a lower GDP per capita should be associated with higher average flows (since capital should be expected to flow to capital-scarce countries) but other effects are conceivable – for example, differences in GDP per capita are also correlated with differences in financial and institutional development.

Treasury yield instead of the global FCI. Online Annex Table 3.1.2 shows detailed results from the quantile regressions.

Online Annex Table 3.1.2. Quantile Regressions Estimation Results: Debt and Equity Portfolio Flows

Dependent Variable: Gross Debt Portfolio Inflows (Sample of 37 Economies)											
	Percentile										
	5	10	20	30	40	50	60	70	80	90	95
FCI	-0.09	-0.09**	-0.05	-0.02	-0.02	-0.04	-0.08*	-0.11**	-0.07	-0.10	-0.07
	(0.07)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.05)	(0.07)	(0.10)	(0.12)
VIX	-0.013	-0.018*	-0.016**	-0.014**	-0.014**	-0.017**	-0.02***	-0.022***	-0.025***	-0.014	-0.020
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
U.S. 10-Year Yield	-0.10	-0.21*	-0.25**	-0.24**	-0.24**	-0.28**	-0.30**	-0.38**	-0.38**	-0.21	-0.40
	(0.19)	(0.12)	(0.11)	(0.11)	(0.11)	(0.13)	(0.14)	(0.15)	(0.19)	(0.27)	(0.33)
DXY	-0.01	-0.01	-0.01	-0.016**	-0.015*	-0.018**	-0.020**	-0.025**	-0.028**	-0.048**	-0.073***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Dependent Variable: Gross Debt Portfolio Inflows (Sample of 18 Economies)											
	Percentile										
	5	10	20	30	40	50	60	70	80	90	95
VIX	-0.017	-0.019	-0.008	-0.008	-0.017	-0.017*	-0.020*	-0.023*	-0.026**	-0.029*	-0.024
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
U.S. 10-Year Yield	-0.64***	-0.54***	-0.52***	-0.40***	-0.42**	-0.39*	-0.41*	-0.3	-0.3	-0.2	0.0
	(0.25)	(0.19)	(0.17)	(0.15)	(0.17)	(0.20)	(0.22)	(0.23)	(0.22)	(0.33)	(0.35)
DXY	-0.03**	-0.03***	-0.029***	-0.032***	-0.037***	-0.034***	-0.035***	-0.032**	-0.028*	-0.036*	-0.055***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Short-term FX	-0.82**	-0.59***	-0.58***	-0.23	-0.03	0.04	0.07	0.23	0.30	0.57	0.86
Debt to Reserves	(0.29)	(0.15)	(0.15)	(0.14)	(0.14)	(0.18)	(0.18)	(0.22)	(0.23)	(0.28)	(0.37)
Financial Markets	1.47	1.93	2.51**	2.62**	2.24	2.45	3.78**	4.42***	4.36***	4.51***	5.21**
Depth	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Dependent Variable: Gross Equity Portfolio Inflows (Sample of 18 Economies)											
	Percentile										
	5	10	20	30	40	50	60	70	80	90	95
VIX	-0.004	-0.002	-0.002	-0.004	-0.004	-0.008***	-0.007**	-0.009***	-0.011**	-0.011	-0.015
	(0.009)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.009)	(0.013)
U.S. 10-Year Yield	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.11*	-0.13**	-0.17***	-0.26***	-0.21*
	(0.14)	(0.12)	(0.08)	(0.06)	(0.06)	(0.07)	(0.07)	(0.06)	(0.06)	(0.08)	(0.13)
DXY	-0.005	-0.005	-0.006	-0.006	-0.008*	-0.007	-0.009*	-0.009*	-0.011*	-0.009	-0.004
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
Short-term FX	-0.08	0.19	0.11**	0.09*	0.04	0.06	0.14	0.20	0.17	0.39	0.43
Debt to Reserves	(0.10)	(0.11)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.06)	(0.08)	(0.13)	(0.17)
Financial Markets	0.07	-0.08	0.17	0.30	0.22	0.60	1.13*	1.39**	1.90**	2.54**	3.49**
Depth	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)

Sources: IMF, Assessing Reserve Adequacy database; IMF, Financial Flows Analytics database; IMF, International Financial Statistics database; Haver Analytics; World Bank and IMF staff calculations.

15. *Comparison between local currency and hard currency portfolio debt flows* (Figure 3.6): Panels 1–3 show the average coefficients from the subsets of quantile regressions for local and hard currency debt portfolio flows (as defined above) based on the sample of 15 countries. The results are based on regressions that include VIX index, the DXY index, and the U.S. 10-year Treasury yield instead of the global FCI. Panel 4 shows the average coefficients on the global FCI index when only the global FCI is included as a measure of global factors in equation (1). Online Annex Table 3.1.3 shows detailed results from the quantile regressions. Standardized coefficients are reported in Online Annex Figure 3.1.1, panel 2.

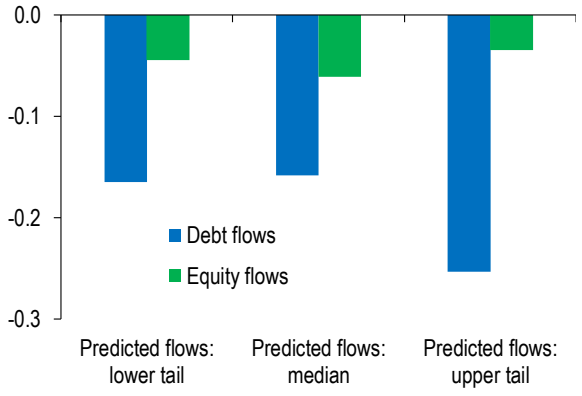
Online Annex Table 3.1.3. Quantile Regressions Estimation Results: Hard and Local Currency Debt Portfolio Flows

Dependent Variable: Gross Hard Currency Debt Portfolio Inflows (Sample of 15 Economies)											
	Percentile										
	5	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**95**
Short-term FX	-0.22	-0.18	0.01	0.02	-0.01	-0.03	-0.03	0.05	-0.09	0.03	-0.13
Debt to Reserves	(0.05)	(0.06)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.07)
Domestic Growth	0.04	0.01	0.00	0.01	0.00	0.01	0.01	0.03	0.01	0.04	-0.02
	(4.44)	(0.44)	(0.29)	(0.25)	(0.31)	(0.27)	(0.30)	(0.33)	(0.40)	(46.50)	(100.55)
Financial Markets	0.61	1.55	3.14	3.57*	3.41**	4.01**	3.71*	3.59**	3.03***	2.39	3.73**
Depth	(0.33)	(0.34)	(0.40)	(0.41)	(0.44)	(0.51)	(0.55)	(0.50)	(0.33)	(0.31)	(0.88)
Global FCI	-0.02	-0.06	-0.05	-0.04	-0.07	-0.04	-0.01	-0.03	-0.06	-0.07	-0.14
	(0.14)	(0.09)	(0.07)	(0.08)	(0.10)	(0.09)	(0.11)	(0.12)	(0.16)	(0.26)	(0.23)
Dependent Variable: Gross Local Currency Debt Portfolio Inflows (Sample of 15 Economies)											
	Percentile										
	5	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**95**
Short-term FX	-0.50***	-0.39**	-0.74**	-0.60	-0.46	-0.32	-0.17	0.20	0.10	0.34	0.54
Debt to Reserves	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.06)	(0.07)	(0.06)
Domestic Growth	0.07***	0.04	0.02	0.00	0.01	0.01	0.04*	0.05	0.03	0.05	0.06
	(2.50)	(3.17)	(0.22)	(0.26)	(0.33)	(0.45)	(0.57)	(0.61)	(0.72)	(29.68)	(78.51)
Financial Markets	2.39	3.10	2.69*	3.02	2.77	4.31	4.07	5.63*	6.07*	6.15**	7.01**
Depth	(0.16)	(0.20)	(0.29)	(0.41)	(0.83)	(0.80)	(0.87)	(1.02)	(0.84)	(1.23)	(0.99)
Global FCI	-0.08	0.00	-0.11	-0.03	-0.01	-0.02	-0.04	-0.09	-0.07	-0.12	-0.01
	(0.22)	(0.18)	(0.11)	(0.09)	(0.08)	(0.07)	(0.09)	(0.09)	(0.09)	(0.13)	(0.15)

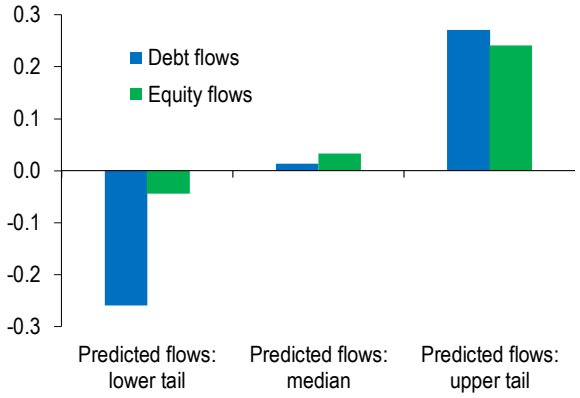
Sources: Haver Analytics; IMF, Assessing Reserve Adequacy database; IMF, Financial Flows Analytics database; IMF, International Financial Statistics database; World Bank and Fund staff calculations.

Online Annex Figure 3.1.1. Standardized Coefficients in Quantile Regressions: Debt versus Equity Portfolio Flows

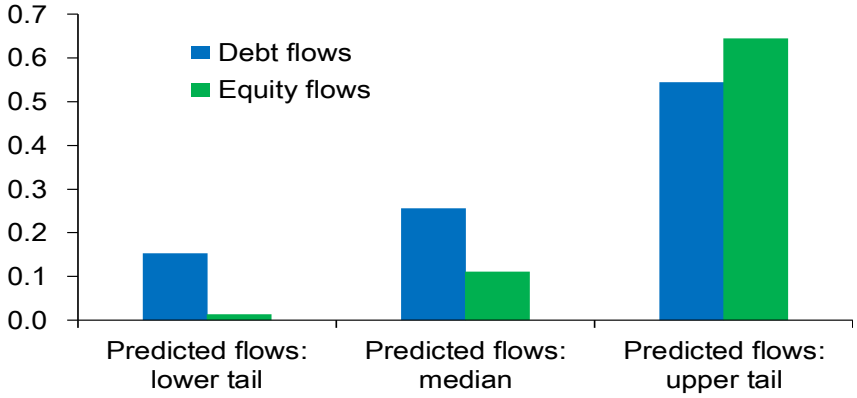
1. Standardized Coefficients on the US Dollar DXY Index from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows



2. Standardized Coefficients on the Ratio of Short-term Foreign Currency Debt to Reserves from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows

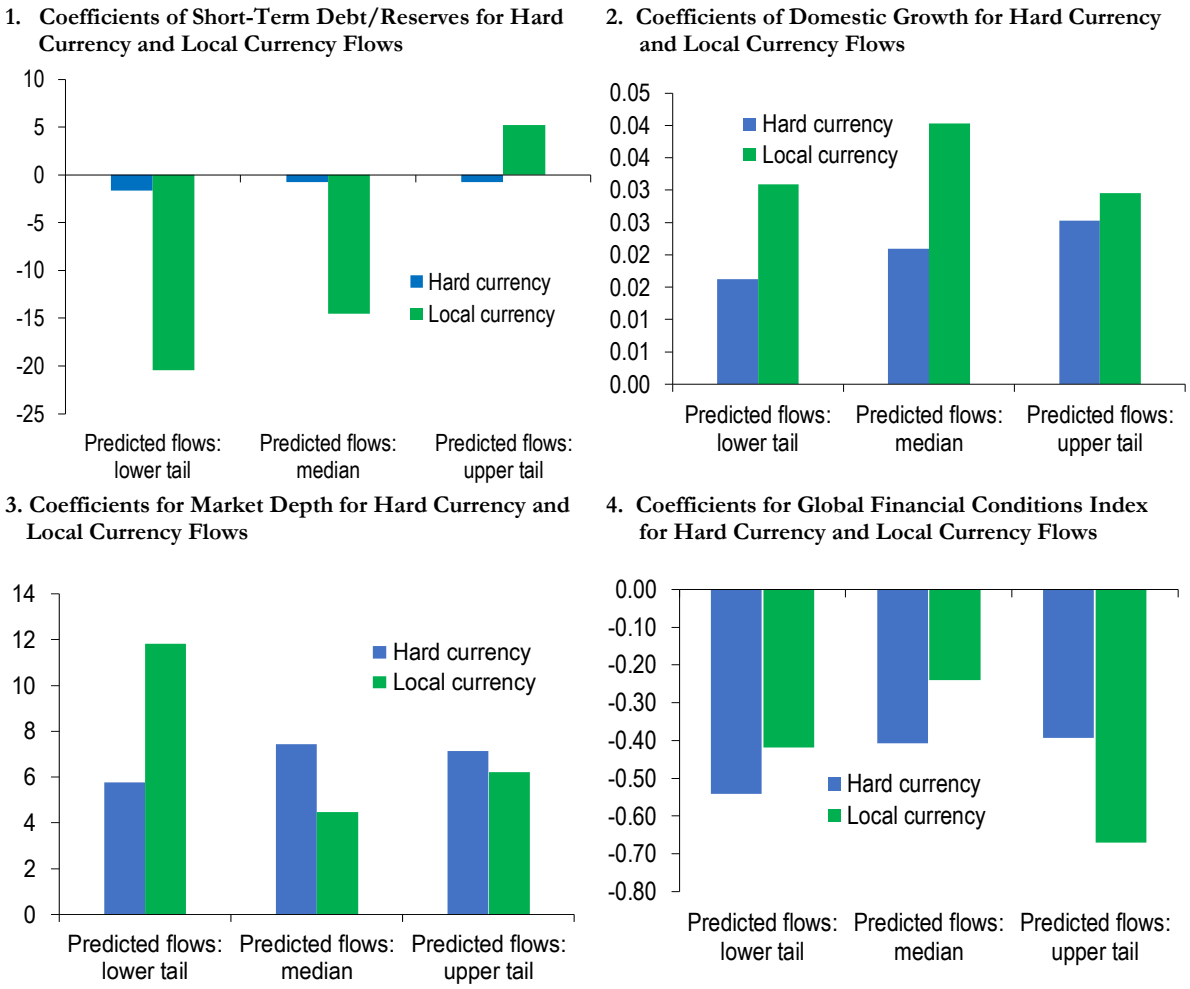


3. Standardized Coefficients on the Depth of Domestic Financial Markets Index from Quantile Regressions of Near-Term Debt and Equity Portfolio Flows



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Assessing Reserve Adequacy database; IMF, Financial Flows Analytics database; IMF, International Financial Statistics database; Institute of International Finance; World Bank and Fund staff calculations.
Note: The *lower tail* corresponds to average coefficients on explanatory variables from regressions for low percentiles (5th,10th, 20th and 30th), *median flows*—to average coefficients from regressions for middle percentiles (40th, 50th, 60th), upper tail—to average coefficients for upper percentiles (70th, 80th, 90th, 95th).

Online Annex Figure 3.1.2. Standardized Coefficients in Quantile Regressions: Local versus Hard Debt Portfolio Flows



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, International Financial Statistics database; IMF, Financial Flows Analytics database; IMF, Assessing Reserve Adequacy databases; Institute of International Finance; World Bank and Fund staff calculations.
Note: The *lower tail* corresponds to average coefficients on explanatory variables from regressions for low percentiles (5th,10th, 20th and 30th), *median flows*—to average coefficients from regressions for middle percentiles (40th, 50th, 60th), upper tail—to average coefficients for upper percentiles (70th, 80th, 90th, 95th).

References

Adrian, T., Boyarchenko, N. and D. Giannone. 2019. "Vulnerable Growth." *American Economic Review*, Vol 109(4), pp. 163–89.

Gelos, G., Górnicka, L., Koepke, R., Sahay, R. and S. Sgherri. 2019. "Capital Flows at Risk: Taming Ebbs and Flows," IMF Working Paper 19/279, International Monetary Fund, Washington, DC

Ghosh, A., Qureshi, M., Kim, J. and J. Zalduendo. 2014. "Surges." *Journal of International Economics* 92, pp. 266–285.

International Monetary Fund. 2017a. "Global Financial Stability Report." Washington, October.

_____. 2018. "Global Financial Stability Report." Washington, October 2018.

_____. 2019. "World Economic Outlook." Washington, October 2019.

Svirydzenka, K. 2016. "Introducing a New Broad-Based Index of Financial Development," IMF Working Paper 2016/5, International Monetary Fund, Washington, DC.

2. Local Currency Bond Yield Valuation[9]

16. The pricing of EM sovereign debt securities is determined by the country-specific fundamentals, external financial conditions but is also influenced by the global investors' risk appetite. The risk appetite becomes especially relevant during periods of stress (González-Hermosillo, 2008), as it could interact with domestic vulnerabilities to amplify the impact on borrowers with weaker fundamentals. For instance, as discussed in October 2018 GFSR, countries with high external debt were disproportionately impacted by a sharp rise in the US dollar during April-September 2018.

Framework and Data

17. A fundamentals-based asset valuation model for EM local currency yields—also considered as the funding costs on the local currency debt—is constructed based on both domestic fundamentals and external financial conditions. The model is similar to the asset valuation model for EM hard currency spreads (Online Annex, GFSR October 2019). The model covers 21 emerging and frontier markets, with quarterly data spanning back to December 2001.[10] However, the time span is uneven, as countries entered the GBI-EM Index in different years (Online Annex Table 3.1.4). The data on local currency bond yields is sourced from Bloomberg based on the JP Morgan indices.

18. Given the data limitations, it is difficult to build reliable country-specific models, especially for countries with short data, the analysis focuses on panel estimation. An OLS model is estimated using an unbalanced panel. The local currency bond yields are regressed on domestic fundamental factors and external financial conditions, as follows:

$$Yield_{it} = c + \sum_{k=0}^{K} Fundamental_{kit} * \beta_k + \sum_{j=0}^{J} GlobalRiskAppetite_t * \alpha_j * Rating_j$$

where

- i (from 1 to 21) is the number of countries in the sample
- k (from 1 to 7) is the number of fundamental factors (outlined below)
- j (from 1 to 2) is the number of ratings (IG and HY)

and the fundamental determinants of the sovereign spreads are:

- Domestic Real GDP growth – 1 year forward consensus forecasts
- Domestic CPI Inflation – 1 year forward consensus forecasts
- Current Account Balance (percent of GDP)
- External Debt (percent of GDP)
- Foreign Currency Reserves (percent of GDP)

---

[9] This section is authored by Rohit Goel.

[10] All countries present in the JP Morgan GBI-EM Index are considered in the sample, with the exception of Argentina.

- External Real GDP growth – 1 year forward consensus forecasts
- US Dollar Index (DXY Index)
- Foreign Investors as a proportion of total ownership

The global risk appetite factor is proxied by the US BBB corporate spread.[11] It is also worth noting that *Rating* is a dummy variable corresponding to whether its an IG-rated country or a HY-rated country. It is not an interaction term.

Online Annex Table 3.1.4. Country Coverage and the Dates at which Yield Data Start

Asia Pacific		Western Hemisphere		EMEA	
Country	Date From	Country	Date From	Country	Date From
India	Dec-01	Brazil	Mar-02	Poland	Mar-01
Thailand	Dec-01	Mexico	Mar-02	Hungary	Dec-01
Malaysia	Dec-01	Colombia	Mar-03	South Africa	Dec-01
Indonesia	Mar-03	Peru	Dec-06	Czech Republic	Dec-01
China	Mar-04	Chile	Sep-10	Turkey	Jun-04
Philippines	Dec-10	Uruguay	Jun-17	Russia	Mar-05
		Dominican Republic	Jun-17	Romania	Mar-13
				Nigeria	Mar-18

Sources: Bloomberg Finance L.P.; JP Morgan Chase & Co., and IMF staff calculations.

[11] The US BBB corporate spread is a price-based measure meant to capture external factors pertaining to both economic fundamentals and other drivers, such as significant political events. As a market-based measure, the BBB US corporate spread can itself be misaligned.

3. Sensitivity and Determinants

19. The final model has an adjusted R^2 of almost 70 percent, with most variables both economically and statistically significant. The analysis shows that strong fundamentals tend to reduce funding costs, while elevated vulnerabilities and lower buffers tend to have the opposite effect (Online Annex Table 3.1.5).[12] High *inflation* increases local currency bond yields, while better *growth* prospects contribute to lower yields. Higher *external debt* and lower *foreign exchange reserves* are associated with higher local currency yields. Lower-rated bond issuers are found to be more vulnerable to swings in *global investor risk appetite* than higher-rated issuers—with the results being consistent with the hard currency spread analysis done in GFSR October 2019. Finally, higher *foreign participation* also helps reduce the local currency yields (as in Ebeke and Lu, 2014).

Online Annex Table 3.1.5. Estimation Results for the Local Currency Bond Yields

	Coefficient	Std Error	T-Stat	P-val	
(Intercept)	4.06	1.22	3.32	0.00	
Domestic GDP Growth	-0.09	0.04	-2.25	0.02	**
Domestic Inflation	0.82	0.04	22.59	0.00	***
External Growth	0.76	0.16	4.70	0.00	***
Current Account Balance	-0.02	0.02	-0.93	0.35	
External Debt	0.01	0.00	6.74	0.00	***
FX Reserves	-0.07	0.01	-8.43	0.00	***
Dollar	-0.03	0.01	-3.24	0.00	***
Foreign Ownership	-1.18	0.58	-2.03	0.04	**
Risk Appetite (IG)	0.00	0.00	4.13	0.00	***
Risk Appetite (HY)	0.01	0.00	8.59	0.00	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 11499
Residual Sum of Squares: 3694.9
R-Squared: 0.67869
Adj. R-Squared: 0.67537
F-statistic: 204.464 on 10 and 968 DF, p-value: < 2.22e-16
F-statistic: 151.065 on 10 and 855 DF, p-value: < 2.22e-16
Unbalanced Panel: n = 64, T = 8-19, N = 979

Sources: Bloomberg Finance L.P.; Consensus Economics; Haver Analytics; IMF, World Economic Outlook database; JP Morgan Chase & Co.; Serkan and Tsuda (2014); and IMF staff calculations.

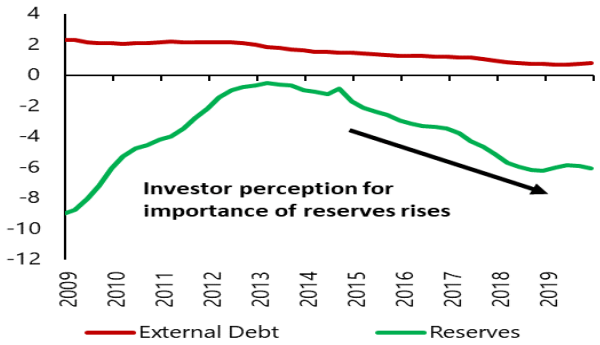
20. Rolling regressions are also run using the same specification, but using time windows of 24 quarters, to understand how the respective sensitivities have changed over time. The analysis highlights that the coefficients on reserves / GDP is rising steadily over the last few years. Every

[12] See Piljak, 2013; Baldacci and Kumar (2010); Jaramillo and Weber (2013).

percentage point rise in reserves/GDP is equivalent to 9 bps decline in funding costs now, compared to only 2 bps reduction during taper tantrum (Online Annex Figure 3.1.3). On the other hand, the coefficient for external debt has moderated somewhat over the last few years as the search for yield has intensified.[13]

Online Annex Figure 3.1.3. Determinants of EM Local Currency Bond Yields

Sensitivity of LC Yields to Reserves/GDP and External Debt to Exports (Coefficient; rolling 24 quarter regression)



Sources: Bloomberg Finance L.P.; Haver Analytics; Institute of International Finance; and Fund staff calculations.

Calculating the Extent of Mispricing

21. The model results can be used to calculate mispricing in two ways:

- **Proportion of countries which are overvalued (Online Annex Figure 3.1.4, panel 1):** This is calculated separately for IG and HY country buckets—weighed by GDP and unweighted. Lower-rated issuers appear to be more overvalued than higher-rated issuers. This includes one-half of the lowest-rated issuers, when weighted by GDP, compared to only 10 percent of higher rated issuers that are estimated to be overvalued.[14]
- **Median overvaluation, in basis points (Online Annex Figure 3.1.4, panel 2):** Overvaluation is defined as model implied yield—market yield. Staff analysis suggests that median yield on emerging market local currency bonds is overvalued relative to these countries' economic fundamentals and external financial conditions, driven in part by the large decline in local currency bonds yields in 2019. The extent of overvaluation is similar to the 2018 emerging market bond sell-off episode, though much less than before the taper tantrum.[15]

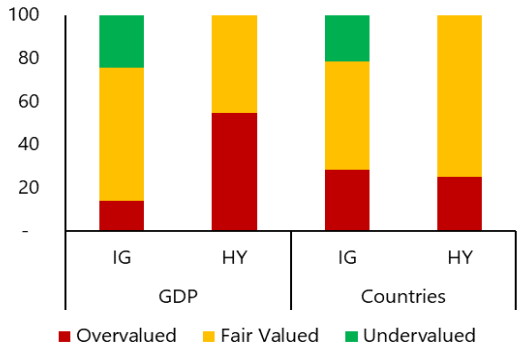
[13] This might also be reflective of lengthening of maturities by the investors.

[14] The trend is similar in the hard currency emerging market bonds (refer GFSR October 2019).

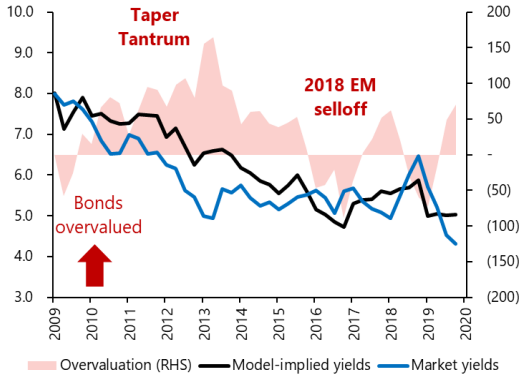
[15] Nonetheless, there is considerable variation across countries, with bonds in about a third of countries estimated to be overvalued, and bonds in about 15 percent of countries estimated to be undervalued.

Online Annex Figure 3.1.4. Extent of Mispricing between Market Yields and Fundamental-Implied Yields

1. Overvaluation per Different Rating Buckets
(Percent of total GDP / countries)



2. Local Currency Bond Yields versus Model-Implied Residuals
(Basis points on the right scale)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, World Economic Outlook database; JPMorgan Chase & Co; and IMF staff calculations.

References

Baldacci E and M Kumar. 2010. "Fiscal Deficits, Public Debt and Sovereign Bond Yields," IMF Working Paper 10/184, International Monetary Fund, Washington, DC.

Dehn, Jan. 2019. "The EM Fixed Income Universe Version 8.0." Ashmore Investments, The Emerging View.

González-Hermosillo, Brenda. 2008. "Investors' Risk Appetite and Global Financial Market Conditions." IMF Working Paper 08/85. International Monetary Fund, Washington, DC.

Guscina, Anastasia, Sheheryar Malik and Michael Papaioannou. 2017. "Assessing Loss of Market Access: Conceptual and Operational Issues." IMF Working Paper 17/246. International Monetary Fund, Washington, DC.

International Monetary Fund, 2019. "Global Financial Stability Report." Washington, October 2019.

_____, 2007. "Global Financial Stability Report." Washington, October 2007.

_____, 2018. "Global Financial Stability Report." Washington, October 2018.

Jaramillo, L. and Michelle Tejada. 2011. "Sovereign Credit Ratings and Spreads in Emerging Markets : Does Investment Grade Matter?", IMF working Paper 11/44, International Monetary Fund, Washington, DC.

Piljak, V. 2013. "Bond markets co-movement dynamics and macroeconomic factors: Evidence from emerging and frontier markets" Emerging Markets Review 17, 29–43.

4. Foreign Participation, Financial Depth and Volatility of Yields[16]

22. The goal of the analysis is twofold: to assess whether (1) foreign participation in local currency debt market is associated with higher volatility of yield after it hits a threshold, and (2) domestic financial market depth can help countries lower volatility.

Sample

23. The analysis has an unbalanced panel from 18 economies in the sample: Brazil, Chile, China, Colombia, Czech Republic, Hungary, Indonesia, India, Mexico, Malaysia, Peru, Philippines, Poland, Romania, Russia, Thailand, Turkey and South Africa. The sample period is 2004:Q2–2017:Q4. Note that results below are not driven by a specific country in the sample.

Variable and Data Description

24. The *dependent variable* is the volatility of government bond yield. Volatility is calculated as the logarithm of the standard deviation of weekly changes in the yield for each quarter to capture the within country-quarter volatility of the government bond yields, as in Ebeke and Kyobe (2014).

25. There are two main (explanatory) variables of interest: foreign participation in local currency debt market and financial depth. The data for foreign participation in the local currency debt market comes from the quarterly dataset by Arslanalp and Tsuda (2014, updated). The analysis uses the ratio of foreign participation in local currency debt market as a share of international reserves. Data on reserves is from the IFS database. To explore if foreign participation as a share of reserves increases the volatility after it exceeds a level, a dummy variable for the foreign participation is defined, which takes 1 after a threshold. However, the analysis also aims to isolate the threshold effect from, if any, the linear effect of foreign participation on volatility. To do this, foreign participation to reserves ratio as a continuous variable is included in regressions to capture its separate effects on volatility. The analysis uses lagged variables for the foreign participation, as with Ebeke and Kyobe (2014), but results are very similar both qualitatively and quantitatively if contemporaneous values are used instead.

26. Financial markets depth is from the financial development database by Sahay et al. (2015), which has annual data until 2017. It incorporates information from stock market capitalization, stocks traded, international debt securities by the government, total debt securities of nonfinancial corporations, and total debt securities of financial corporations as shares of GDP. The analysis also tests results using a proxy for financial institutions depth from the same

[16] This section is authored by Dimitris Drakopoulos and Can Sever.

dataset. It is an index consisting of private sector credit, pension fund assets, mutual fund assets and insurance premiums as share of GDP (Online Annex Table 3.1.6).

Online Annex Table 3.1.6. Definitions of Financial Institutions and Financial Markets Depth Variables

	FINANCIAL INSTITUTIONS	FINANCIAL MARKETS
DEPTH	1. Private-sector credit (% of GDP) 2. Pension fund assets (% of GDP) 3. Mutual fund assets (% of GDP) 4. Insurance premiums, life and non-life (% of GDP)	1. Stock market capitalization to GDP 2. Stocks traded to GDP 3. International debt securities government (% of GDP) 4. Total debt securities of nonfinancial corporations (% of GDP) 5. Total debt securities of financial corporations (% of GDP)

Sources: Sahay et al. (2015).

Baseline Model Specification

27. The analysis also controls for current account balance, external debt and government debt as shares of GDP (from WEO database)(from Haver) which are at annual frequency. Other control variables, inflation (change in the CPI), the exchange rate vis-à-vis USD, reserves as a share of GDP and growth rate of GDP from IFS database are at quarterly frequency. The analysis also includes turnover in FX market from triennial central bank surveys by the BIS. Results are robust to dropping any of these control variables. Country and quarter fixed effects are used to control for unobservable time-invariant features at the country-level, and year-specific shocks that are common across all EMs such as developments in the US rates.

The specification is as follows:

$$Volatility_{ct} = \alpha_1\, Threshold(Foreign\ Participation)_{ct-1} + \alpha_2\, Financial\ Markets\ Depth_{ct} + \Theta Controls_{ct} + \mu_c + \Theta_t + e_{ct} \quad (3)$$

where c is country, t is quarter, μ_c and Θ_t stand for country and quarter fixed effects. $Threshold(Foreign\ Participation)_{ct-1}$ is the dummy variable which takes 1 for values of the ratio of foreign participation to reserves above a level, and 0 otherwise. $Controls_{ct}$ include several domestic variables, as well as the ratio of foreign participation to reserves, as mentioned before. The coefficient estimate α_1 must be positive if foreign participation is associated with higher volatility after a threshold, and α_2 to be negative if financial markets depth helps countries decrease volatility.

Estimation Results

28. Online Annex Table 3.1.7 illustrates the results. The analysis starts the search for the level of the threshold effect from very low levels of foreign participation. The results suggest that the threshold dummy becomes statistically significant only after the foreign participation to reserves ratio exceeds 40 percent. First 3 columns show that although it is positive, $\alpha_1$is not statistically significant when the dummy is defined using 37, 38, and 39 percent levels, respectively.

However, as the fourth column shows, it becomes statistically significant (at 5 percent level) starting from the 40 percent level. The point estimates suggest that as the foreign participation exceeds 40 percent, the volatility increases by 15 percent. Results hold and are statistically significant for the 41, 42, and 43 percent thresholds in columns 5, 6 and 7, respectively. It is important to note that the ratio of foreign participation to reserves (continuous variable itself) has statistically insignificant coefficients throughout regressions. Thus, the only statistically significant effect of foreign participation on volatility arises from the threshold effect.

29. The analysis also finds strong evidence for the effect of financial depth on volatility. In first 7 columns, financial markets depth has statistically significant (at 1 percent level) coefficients. The coefficient estimates in column 4 suggests that one standard deviation increase (0.21) in the financial markets depth in the sample is associated with 20.6 percent decrease in volatility. The last column shows that results are also robust to using financial institutions depth, instead of financial markets depth.

Online Annex Table 3.1.7. Estimation

	The dummy for the threshold takes 1 after the ratio of foreign participation to reserves exceeds							
Variable (percent)	37	38	39	40	41	42	43	40
Threshold Dummy	0.009	0.06	0.09	0.147**	0.163**	0.205***	0.188**	0.152*
	-0.063	-0.066	-0.067	-0.068	-0.07	-0.074	-0.074	-0.08
Financial Markets Depth	-1.051***	-1.029***	-1.015***	-0.980***	-0.969***	-0.967***	-0.980***	
	-0.358	-0.3564	-0.355	-0.353	-0.351	-0.349	-0.348	
Financial Institutions Depth								-1.165**
								-0.6
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	741	741	741	741	741	741	741	741
R Squared	0.606	0.606	0.607	0.608	0.609	0.61	0.609	0.605

Source: IMF staff calculations.
Note: The estimation is based on equation (3) using quarterly data from 18 EMs from 2004:Q2–2017:Q4. Dependent variable is the logarithm of the volatility of yield. The threshold dummy is defined using different thresholds of foreign participation in local currency bond markets to reserves ratio. Control variables are lagged value of foreign participation to reserve ratio; and current account balance, external debt, government debt, inflation, reserves, exchange rate against USD, and turnover in the FX market. Control variables, and country and quarter fixed effects are included in all regressions. ***p<0.01, **p<0.05, *p<0.1.

30. Finally, we test for a slope effect of foreign participation on volatility after it reaches to 40 percent threshold as found above. We add an interaction between the threshold dummy for foreign participation and the ratio of foreign holdings to reserves into equation (3) above. Although interpretation of the alternative model is different, Table 3.1.8 shows that previous finding that foreign participation increases volatility after 40 percent threshold stays the same.

The first distinction in this model is that foreign participation to reserves has a (statistically significant) decreasing effect on volatility when it is below 40 percent threshold. However, if it is above 40 percent, it increases volatility comparing the coefficient estimates of the ratio and the interaction term (column 3 and 4). The second implication from this model is that as the foreign participation keeps increasing above 40 percent, the effect of volatility becomes stronger. The effect of financial market depth on volatility stays similar.

Online Annex Table 3.1.8. Alternative Model

Variable	Threshold Dummy	The Ratio of Foreign Participation to Reserves	Threshold Dummy x Foreign Participation to Reserves	Financial Markets Depth
	-0.266	-1.047**	1.120***	-0.939***
	(0.163)	(0.416)	(0.424)	(0.348)

Source: IMF staff calculations.
Note: IMF staff calculations. R-squared is 0.612. Number of observations is 741. The estimation is based on quarterly data from 18 EMs from 2004:Q2–2017:Q4. Dependent variable is the logarithm of the volatility of yield. The threshold dummy is defined using the 40% threshold of foreign participation in local currency bond markets to reserves ratio. Control variables are lagged value of foreign participation to reserve ratio; and current account balance, external debt, government debt, inflation, reserves, exchange rate against USD, and turnover in the FX market. Control variables, and country and quarter fixed effects are included in all regressions. ***p<0.01, **p<0.05, *p<0.1.

References

Serkan Arslanalp and Takahiro Tsuda (2014, updated) "Tracking Global Demand for Emerging Market Sovereign Debt," IMF Working Paper WP/14/39, International Monetary Fund, Washington, DC.

5. List of Countries Includes in Selected Figure of Chapter 3

31. **Figure 3.2,** panel 1 includes a sample of 20 emerging markets and 20 frontier markets. Emerging markets include: Argentina, Brazil, Bulgaria, Chile, Colombia, Czech Republic, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Turkey, United Arab Emirates. Frontier markets include: Angola, Belarus, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Georgia, Ghana, Guatemala, Jamaica, Jordan, Mongolia, Mozambique, Namibia, Nigeria, Pakistan, Paraguay, Sri Lanka, and Tanzania.