EXECUTIVE BOARD MEETING

SM/20/153

CONFIDENTIAL

September 17, 2020

To: Members of the Executive Board

From: The Secretary

Subject: **October 2020 Global Financial Stability Report—Analytical Chapter 2 and Online Annex**

Board Action:	Executive Directors' **consideration** (Formal)
Tentative Board Date:	**Wednesday, September 30, 2020**
Publication:	Yes, it is intended that the October 2020 Global Financial Stability Report documents will be released to the public at the time of the Global Financial Stability Report press conference, tentatively scheduled for **Friday, October 2, 2020**. The analytical chapters will be made available to the public on the IMF website in advance of the publication of the full document.
Questions:	Mr. Natalucci, MCM (ext. 37108) Ms. Ilyina, MCM (ext. 35351) Mr. Papageorgiou, MCM (ext. 34261)
Additional Information:	The paper will be revised for publication in light of the Executive Board discussion. If Executive Directors have additional comments, they should notify Mr. Natalucci, Ms. Ilyina and Mr. Papageorgiou by **5:30 p.m. on Friday, October 2, 2020.**

EMERGING AND FRONTIER MARKETS

Approved By
Tobias Adrian

Prepared by staff from the Monetary and Capital Markets Department (in consultation with other departments): The authors of this chapter are Dimitris Drakopoulos, Rohit Goel, Evan Papageorgiou (team leader), Dmitri Petrov, Patrick Schneider, Can Sever, and Jeff Williams, under the guidance of Fabio Natalucci and Anna Ilyina. Magally Bernal and Andre Vasquez were responsible for word processing and the production of this report.

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Chapter 2 at a Glance

- To mitigate stress in local bond and currency markets, many emerging market central banks used foreign exchange (FX) interventions and, for the first time, asset purchases.
- This *Global Financial Stability Report* (GFSR) presents a novel *local stress index* to measure the stress in local bond and currency markets.
- Asset purchase programs (APPs) helped lower government bond yields, did not lead to FX depreciation, and eventually reduced market stress. Asset purchases may have a role to play going forward, but ongoing evaluation of the risks is also needed.
- Strategies to address debt distress in frontier markets need to consider the impact of the expected treatment of different creditors in future debt restructurings on investor perception of risk.

A Greater Set of Policy Options to Restore Stability

The pandemic has hit emerging and frontier market economies hard, but the policy response has been equally strong. Policymakers have taken steps to soften the hit to economic activity, ease financial conditions, and reduce stress in domestic markets. For the first time, many emerging market central banks have launched asset purchase programs to support the smooth functioning of financial markets and the overall economy. Asset purchases have been effective in reducing bond yields and have not contributed to currency depreciation, but they appear to have taken longer to reduce broader domestic bond market stress. This chapter examines the effectiveness of these unconventional policy measures and concludes that asset purchases with credible monetary policy frameworks and good governance may be a useful addition to the policy toolkit of central banks in emerging and frontier market economies, although a careful ongoing evaluation of associated risks is needed, especially for open-ended programs. In frontier market economies, the policy focus has been on addressing the effect of the pandemic while dealing with high debt. This chapter examines the potential impact on investor perception of sovereign risk as a result of the expected treatment of different classes of creditors in future debt restructurings.

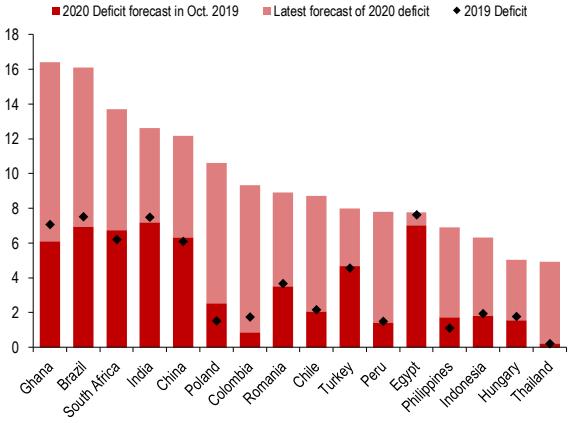
The Global Pandemic Has Required Bold Action

1. Emerging market economies have responded forcefully to the coronavirus disease (COVID-19) crisis. As a result of the sudden and unprecedented shock to economic activity, most governments have increased spending for emergency measures and transfers (Figure 2.1, panel 1). Over 90 percent of central banks have cut policy rates since March—some to all-time lows—and many have taken measures to provide liquidity to the banking system (Figure 2.1, panels 2 and 3). As a result of these measures and buoyant global risk appetite, financial conditions have eased considerably (see Chapter 1).

Figure 2.1. Emerging Market Policy Response to the COVID-19 Pandemic

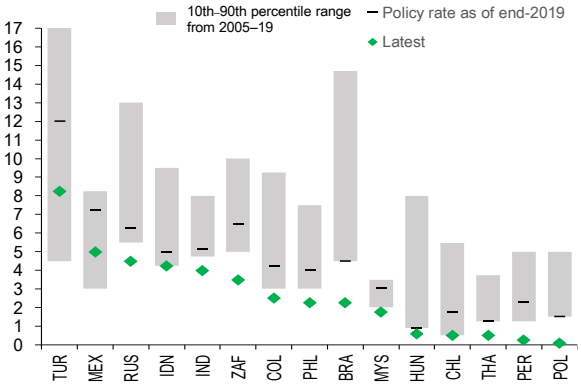
The need for emergency spending and the hit to revenues from the sharp economic shock of the COVID-19 crisis increased budget deficits …

1. General Government Deficit (Percent of GDP)



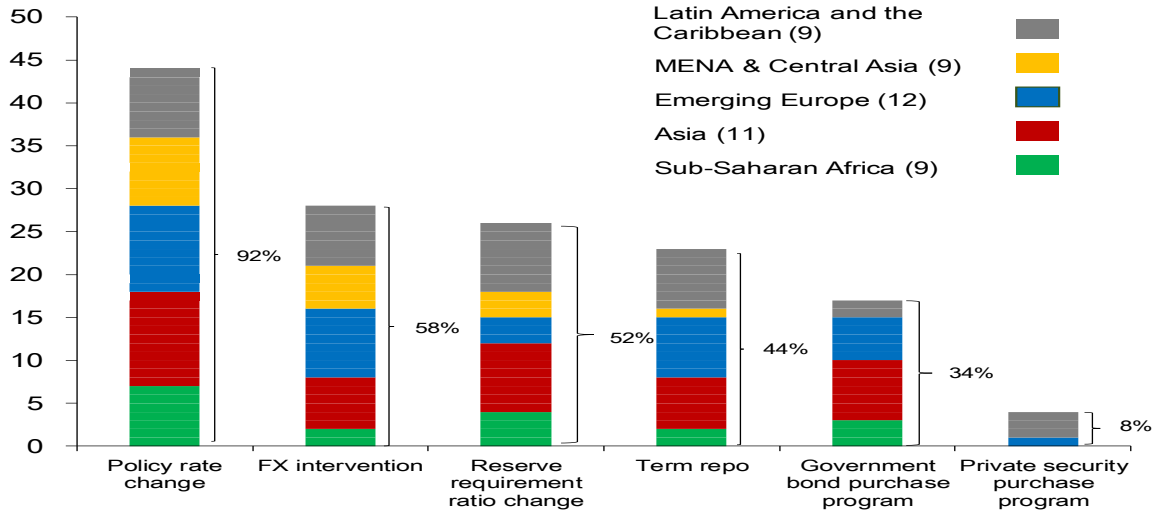
… and most central banks have aggressively cut rates, some to all-time lows.

2. Monetary Policy Rates (10th–90th percentile range, percent)



In addition to rate cuts, central banks have responded forcefully to the COVID-19 crisis with an array of measures to boost market liquidity and stabilize economic and financial conditions.

3. Central Bank Policy Actions (Number of central banks on *y*-axis; percent of sample in brackets)



Sources: Bloomberg Finance L.P.; IMF Central Bank Intervention database; *World Economic Outlook;* and IMF staff calculations.
Note: In panel 3 countries are counted only once per action (e.g, multiple policy rate cuts are counted once). The sample comprises 50 central banks from broadly defined emerging market economies, which are listed in Online Annex 2.1, and quantified by region in parentheses. Data labels in panel 2 use International Organization for Standardization (ISO) country codes. FX = foreign exchange; MENA = Middle East and North Africa.

2. This chapter discusses the historic policy responses of emerging market policymakers to the global pandemic and the financial stability implications of those policies. The "FX Intervention by Emerging Market Central Banks" section considers the use and effectiveness of FX interventions during the peak of the crisis and reviews central bank asset purchases—a new policy tool for emerging market economies—including an examination of their effectiveness and lessons to evaluate their risks in the two sections that follow. "The Role of the Official Sector in

Frontier Market Economy Debt Restructuring" section discusses many frontier market economies' loss of market access because of COVID-19 and the potential impact of different classes of creditors on debt restructurings and on investor perception of sovereign risk. Building on the findings of the chapter, the final section offers policy recommendations. The apparent absence to date of capital flow management measures during the COVID-19 crisis and China's policy challenges in maintaining supportive financial conditions are briefly examined as well (Online Annex Boxes 2.1 and 2.2).

FX Intervention by Emerging Market Central Banks

3. FX interventions, including in some cases through forward contracts, were widespread at the height of the crisis in March, as policymakers sought to insulate their economies from external movements in the pricing of risk. While many countries intervened, surpassing recent stress episodes in absolute size (Figure 2.2, panel 1), the use of reserves (as a share of total international reserves) was modest—about half the magnitude observed during the global financial crisis (Figure 2.2, panel 2). The limited and short-lived use of reserves can potentially be attributed to a relatively short duration of the stress episode due to a quick turnaround in global risk sentiment, which has also likely reduced the need for the capital flow management measures (see Online Annex Box 2.2).

4. IMF staff analysis shows that global factors, including Federal Reserve rate cuts and global risk appetite (proxied by the Chicago Board Options Exchange Volatility Index [VIX][1]), played a significant role in driving currency surprises[2] during the COVID-19 sell-off (Figure 2.2, panel 3). Domestic policy rate cuts and FX interventions, on the other hand, had a relatively insignificant impact. This contrasts with the 2015 sell-off, which was more specific to emerging markets and not driven by exogeneous global shocks, and during which emerging market currencies were significantly affected by domestic FX interventions and policy rate cuts (Figure 2.2, panel 4).

The New Game in Town: Central Bank Asset Purchases

5. During the COVID-19 crisis, for the first time on a broad basis, at least 18 emerging market central banks adopted unconventional policies through the use of asset purchase programs[3] targeting government or private sector bonds in local currency. In several cases the purchases were sterilized, which alleviated downward pressure on exchange rates. The scope

[1]Other policy variables, such as announcements by the Federal Reserve of additional purchases, credit facilities, and swap lines, must have also affected emerging market currencies indirectly, but a significant part of that impact should be reflected through global risk appetite.

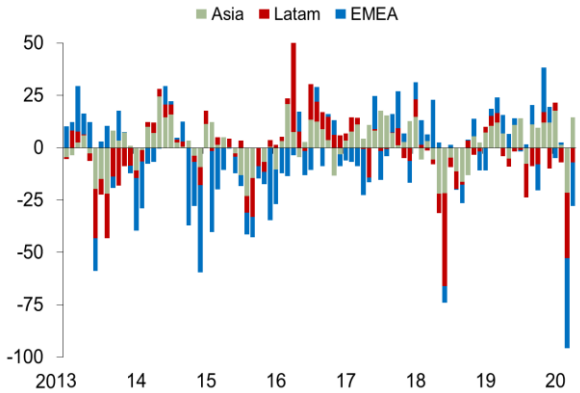
[2] The results are broadly consistent even when simple currency changes are considered. For more details, see Online Annex 2.1.

[3] For the purpose of this GFSR an asset purchase program is the expansion of the central bank balance sheet via purchases of various type of securities. Asset purchase programs include quantitative easing programs that aim to ease financial conditions and provide monetary stimulus, more limited programs that aim to improve market functioning, and purchases in primary markets that aim to assist with government financing requirements. Some countries in the sample set up new purchase programs (for example, Chile, Hungary); others adjusted their existing open market operations (for example, Malaysia, Turkey).

Figure 2.2. FX Interventions and Reserve Operations

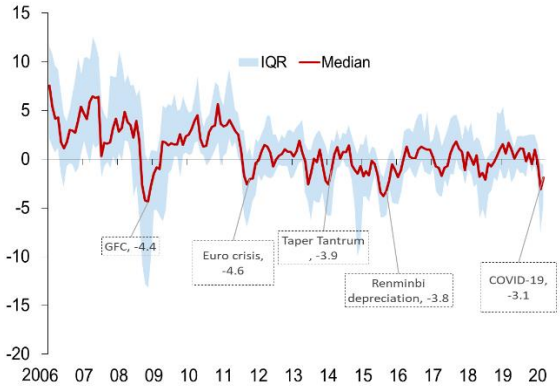
Reserve operations were substantial and widespread in dollar terms …

1. Reserve Operations by Region (US dollars)



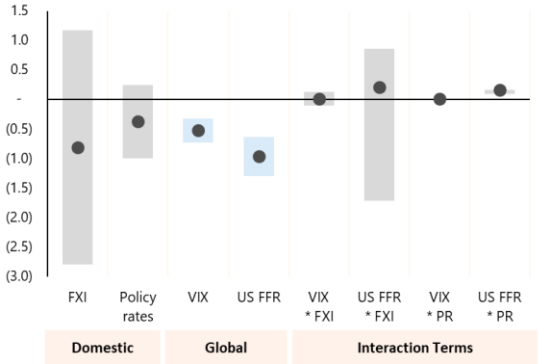
… though as a share of reserves they never reached the level of the global financial crisis and receded quickly.

2. Reserve Operations (Share of reserve stock, three-month rolling sum)



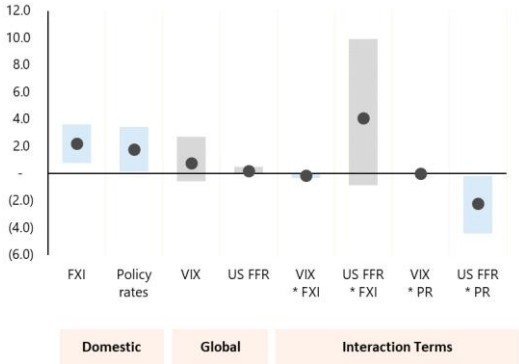
Global factors played a significant role in driving emerging market currency surprises during the COVID-19 sell-off …

3. Coefficients for the Drivers of the EM FX Surprise during the COVID-19 Sell-off (January 2020–May 2020)



… in sharp contrast to the 2015 emerging market sell-off, when domestic factors played a significantly more important role.

4. Coefficients for the Drivers of EM FX Surprise during the 2015 EM Sell-off (April 2015–February 2016)



Sources: Bloomberg Finance L.P.; Haver Analytics; International Institute of Finance; data set from Adler and others (forthcoming); and IMF staff calculations.

Note: In panels 1 and 2, data are as of end-May 2020. Data for May include estimates for operations only in the spot market, while data for April and earlier include estimates for operations in spot as well as derivatives markets. Operations in derivatives markets do not represent a drag on the reserve stock but are included in the calculations to estimate the size of the intervention. These estimates do not adjust for foreign exchange bond sales/purchases, so they may represent a partial picture in a few cases (for example, Mexico). In panels 3 and 4, the sample consists of 14 emerging markets with panel data at monthly frequency (see Online Annex 2.1 for more details). The dependent variable is the forecast error between the spot currency value and the value forecast by the previous month's forward contracts. A positive value implies that the currency appreciated versus market expectations, assuming parity holds. In reality, the forward values might vary from spot for an extended period of time, but the changes in this metric will still highlight currency pressures, albeit only partially. The results hold broadly true even if the dependent variable is taken as foreign exchange appreciation. Foreign exchange intervention (FXI) is calculated as valuation-adjusted changes in reserves, and the intervention as taken in the derivative markets. A positive value means active intervention. Country fixed effects are included. Coefficient estimates are shown with two standard error confidence intervals. In panels 3 and 4, blue bars are the statistically significant coefficients, while gray bars are not statistically significant. EM = emerging market; EMEA = Europe, Middle East, and Africa; FFR = Federal funds rate (effective); GFC = global financial crisis; IQR = interquartile range; Latam = Latin America; PR = policy rate; VIX = Chicago Board Options Exchange Volatility Index.

and motivation of these programs varied across economies (see Table 2.1 and Figure 2.3, panel 1), and the objectives were often multifaceted, but a view toward the available conventional monetary policy space allows for the identification of three broad groups:

- Central banks with *policy rates well above zero* tended to use asset purchase programs as a tool to improve bond market functioning (India, South Africa, Philippines) and provide liquidity to the financial sector. In some cases, central banks may have seen nominal policy rates below a certain level as counterproductive, primarily because of fears over portfolio outflows and ineffective policy transmission.
- Central banks with *policy rates closer to the zero lower bound* (Chile, Poland, Hungary) have partially sought to use asset purchase programs for similar reasons as advanced economies, to ease financial conditions and provide additional monetary stimulus.
- Some central banks explicitly stated that their objective was to temporarily *ease government financing pressure* in the face of the once-in-a-generation global pandemic (Ghana, Guatemala, Indonesia, and the Philippines through its repurchase agreement).

6. Central bank purchases of government securities played an important role in some domestic bond markets during the acute phase of the sell-off. Beginning in February 2020 (Figure 2.3, panel 2), almost all economies faced sizable local currency bond outflows. Central bank asset purchases varied substantially in size, but in most cases they helped the domestic investor base absorb much of the outflow pressure and deal with the government's increased financing needs. For example, in Poland between the end of February and June the central bank purchased more than 2 percent of GDP in government bonds in the secondary market compared with outflows of 0.7 percent of GDP, alongside an increase in net domestic issuance of 4.4 percent of GDP. In some countries that did not launch asset purchase programs, debt management offices limited the local bond supply to avoid further deterioration of already stressed local bond markets. Instead, they relied on alternative sources of financing (for example, the use of cash buffers in Brazil, increased external issuance in Mexico, and pension funds in some Latin American countries) or back-loaded issuance to the second half of the year.

Local Market Stress Is Greater in Bonds than in Currencies

7. This GFSR introduces a novel market conditions index designed to assess the level of stress in local bond and currency markets. The *local stress index* (LSI) summarizes conditions into an indicator that can help guide central bank decisions regarding the need for interventions to support local market functioning. Unlike financial conditions indices, which can loosen or tighten as a result of changes in policy rates or external spreads—as a reflection of the cost of funding—the LSI focuses on local market liquidity and stress indicators (such as bid-offer spreads, realized volatility, and other risk premium measures).[4]

[4] For details, see Online Annex Box 2.1, available at www.imf.org/en/Publications/GFSR.

Table 2.1. Asset Purchase Programs in Emerging and Frontier Market Economies

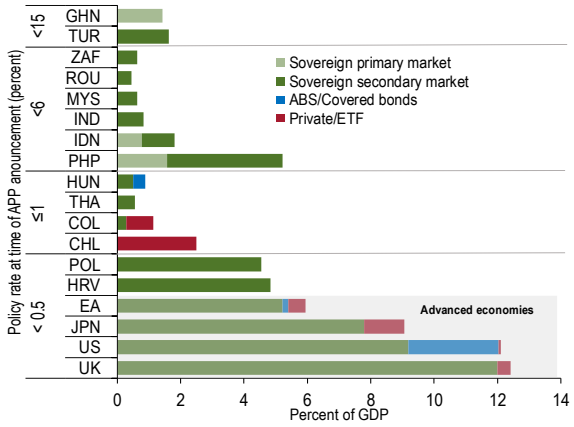
Country	Primary Objectives	Asset Type	Target or Limit Size (Local currency unless specified)	Market	Total Purchases (percent of GDP)	Program Duration (observed or explicit)	Program Announcement Dates	General Government 2020 Deficit (percent of GDP)	Government Debt (percent of GDP)
Colombia	Provide liquidity to the financial sector	Govt., private sector bonds	10 trillion private, up to 4 trillion government	Secondary	**1.1**	March–April	March 23	-5.3	64.2
Chile	Facilitate monetary policy transmission, ease financial conditions	Bank, central bank, and govt bonds*	$16 billon across 3 announcements	Secondary	**2.5**	March–present	March 16, March 31, June 16, August 12	-8.7	34.8
Croatia	Stabilize domestic bond market	Govt bonds	Not specified	Secondary	**4.8**	March–June	March 13	-7.9	86.1
Ghana	Finance budget deficit	Govt bonds	5.5 billion (up to 10 billion)	Primary	**1.4**	May	May 15	-10.0	67.6
Guatemala	Finance budget deficit	Govt bonds	11 billion	Both	**1.9**	June–August	April 8	-6.1	32.5
Hungary	Facilitate monetary policy transmission at longer maturities, provide financial sector liquidity	Govt., mortgage bonds (MBs)	1 trillion in govt, 300 billion in MBs at first, but no upper limit	Both (only MBs in primary)	**0.9**	May–present	April 7, April 28, July 21, August 25	-4.9	72.2
India	Stabilize domestic bond market	Govt. bonds	Not specified	Secondary	**0.8**	March–present	March 18	-12.1	84.0
Indonesia	Stabilize domestic bond market, provide liquidity to the financial sector, finance budget deficit	Govt bonds	Initially not specified, with direct "burden sharing" of 397.6 trillion later announced	Both	**1.8 (3.6)***	Mar–present	March 31, July 7	-6.3	37.7
Malaysia	Provide liquidity to financial sector	Govt bonds	Not specified	Secondary	**0.6**	March–June	March 25	-6.0	65.5
Philippines	Provide liquidity to financial sector, stabilize bond market, finance budget deficit (repurchase agreement)	Govt bonds, including repurchase agreement	300 billion repo, secondary market purchases not specified	Both	**3.6 (5.2)***	March–present	March 23, April 10	-6.9	46.0
Poland	Strengthen monetary policy transmission at longer maturities, stabilize domestic bond market, provide liquidity to financial sector	Govt., SOE bonds	Not specified	Secondary	**4.6**	Mar–present	March 17, April 8	-8.1	54.3
Romania	Provide liquidity to financial sector	Govt. bonds	Not specified	Secondary	**0.4**	March–present	March 20	-8.9	43.9
South Africa	Stabilize domestic bond market	Govt. bonds	Not specified	Secondary	**0.6**	March–present	March 25	-14.8	79.9
Thailand	Stabilize domestic bond market	Govt., central bank bonds	Not specified	Secondary	**0.6**	March–April	March 19, March 22	-4.9	49.5
Turkey	Provide liquidity to financial sector, strengthen monetary policy transmission mechanism, secure credit conditions	Govt. bonds	Not specified, but OMO portfolio limited to 10 percent of balance sheet	Secondary	**1.6**	Mar–present	March 31	-8.4	40.4

Sources: National authorities, local media, IMF staff estimates.
Note: Total purchase amounts are estimates through August. Indonesia includes Staff estimates of secondary market purchases, primary market purchases prior to July, and the share of the 397.6 tn July burden sharing agreement purchased through August, with full amount noted in parentheses; Philippines includes Staff estimates of secondary market purchases and 3 month bond repurchase agreement of 1.6 percent of GDP with Bureau of Treasury added in parentheses, and the central bank (BSP) opened its purchase window in March prior to written announcement on April 10; Poland includes purchases of bonds from the State Development Bank (BGK) and State Development Fund (PFR); Thailand purchases do not include central bank bonds, Bank of Thailand also authorized a Corporate Stabilization Fund for short-term financing not included here; and Chile's central bank did not gain the legal ability to purchase government bonds until August 12. Papua New Guinea, Jamaica, Sri Lanka, and the Central African Economic and Monetary Community (through the Bank of Central African States) are not included in the table but engaged in asset purchases of various forms. Brazil outlined plans to purchases corporate bonds in June, but had yet to do so. Egypt announced intention to purchases equities in March. OMO = open market operations. bn = billion, tn = trillion.

Figure 2.3. Central Bank Asset Purchases in Emerging Markets

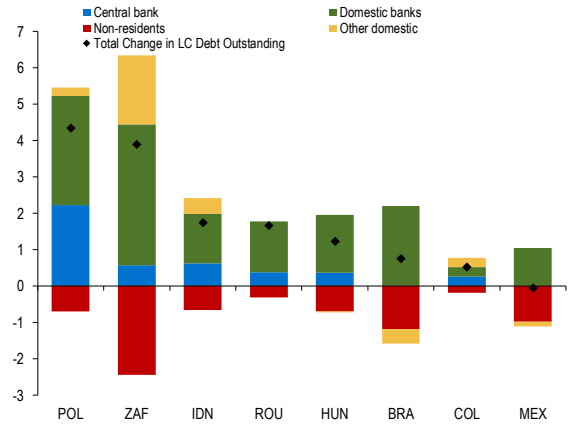
Asset purchase programs in emerging markets differ in scope, size, and duration from those in advanced economies and are often used with higher policy rates.

1. Central Bank Asset Purchases through August (Percent of GDP)



Central bank purchases helped offset portfolio outflows during the crisis period in some economies.

2. Change in Local Currency Government Bond Holdings, Feb–June 2020 (Percent of 2020 GDP)



Sources: Bloomberg Finance L.P.; Haver Analytics; national sources; World Bank; and IMF staff calculations.
Note: Sovereign purchases for Poland in panel 1 include those from the state development bank (BGK) and the state development fund (PFR), which are excluded in panel 2. In panel 2, the total equals the change in local currency government paper outstanding. Totals for Romania and South Africa may differ slightly from aggregated holdings. Data are not adjusted for inflation-linked bonds. Data labels use International Organization for Standardization (ISO) country codes. ABS = asset-backed securities; APP = asset purchase program; ETF = exchange-traded fund.

8. The level of stress in local markets during the COVID-19 sell-off, as measured by the LSI, was comparable to that of the global financial crisis, but the period of stress was considerably shorter. In aggregate (Figure 2.4, panel 1), the level of stress was well above that of previous episodes, such as the 2013 taper tantrum and 2014–15 stress episodes. However, markets have been normalizing much faster than during previous episodes (Figure 2.4, panel 2).

9. A large part of the increase (and subsequent partial reduction) in stress in local bond markets originated from developments in the global financial markets. In line with past episodes of sharp tightening in global financial conditions, the spillovers in FX markets emanating from the United States and the European Union rose sharply (Figure 2.4, panel 3) as currencies played their role as shock absorbers.[5] However, unlike what happened during past tightening episodes, the spillovers to local bond markets were more pronounced (Figure 2.4, panel 4). Most emerging markets have seen a large increase in nonresident participation in their local bond markets since the global financial crisis, which may have exacerbated increased volatility spillovers during the recent sell-off.

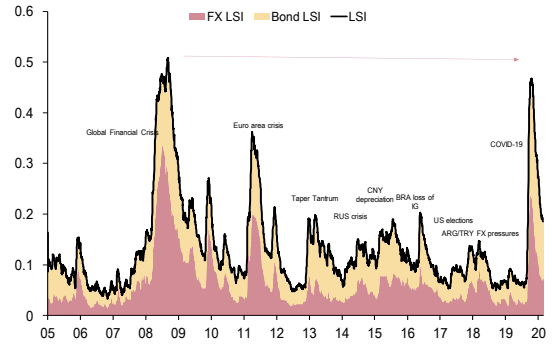
10. The stress in FX markets was lower than during 2008–09, with less noticeable demand for dollar liquidity. For example, increases in measures such as risk reversals, which indicate the

[5] Spillover indices in figure 2.4 panel 1 are calculated using the approach in Diebold and Yilmaz (2012), in which time-varying spillovers are constructed using rolling generalized forecast error decompositions. The index is the contribution from a shock to market X to the overall variability in any other market Y.

Figure 2.4. Stress in Local Currency Bond and FX Markets

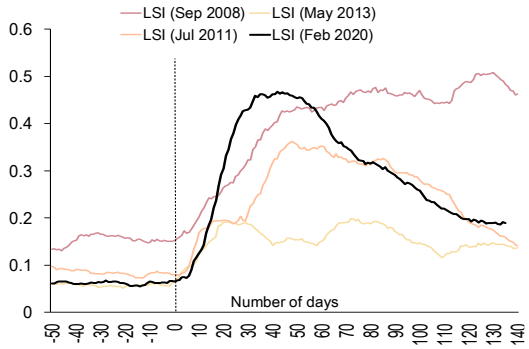
The COVID-19 shock led to significant market dysfunction comparable to that of the 2008 global financial crisis.

1. Emerging Market Local Stress Index (Index)



Stress dissipated faster than in previous episodes but remains elevated.

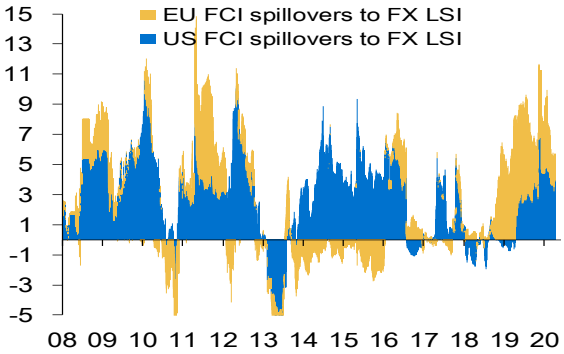
2. Emerging Market Local Stress Index (Dates in parentheses correspond to day = 0)



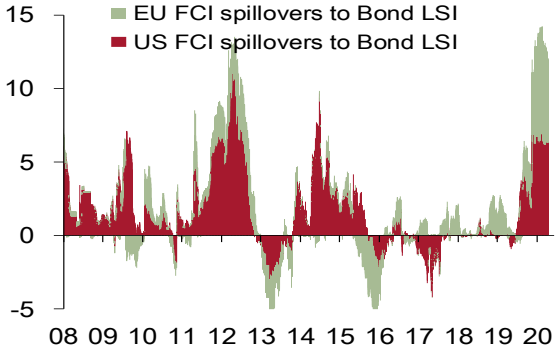
The spillovers of tightening US/EU financial conditions to FX markets were of the same magnitude as in the past …

… while the spillover to bond market conditions was more pronounced now than in the past.

3. Bilateral Net Spillovers from the United States and the Euro Area to the FX LSI (Index)



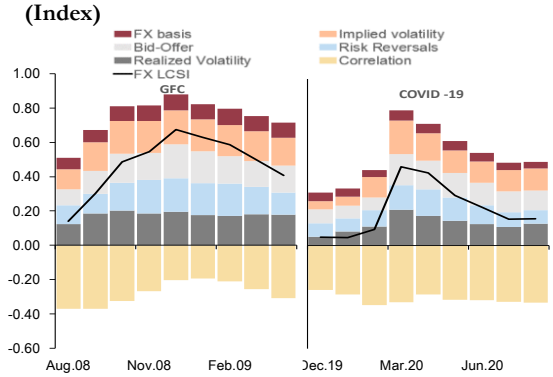
4. Bilateral Net Spillovers from the United States and the Euro Area to the Local Bond LSI (Index)



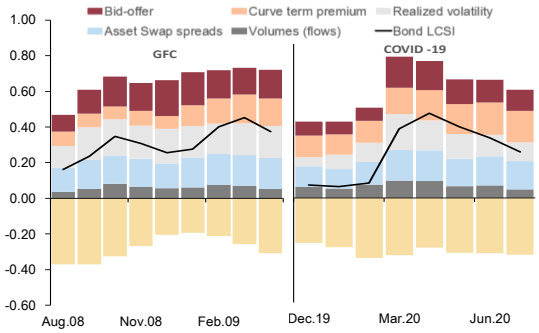
Policy actions in FX markets normalized conditions quickly, but …

… local bond markets remained dysfunctional for longer, triggering asset purchase programs.

5. FX LSI and Components (Index)



6. Local Bond LSI and Components (Index)



Sources: Bloomberg Finance L.P.; and IMF staff calculations.
Note: The local stress index (LSI) is calculated from the country LSIs of 16 countries. For more information see Online Annex 2.1. FCI = financial conditions index; FX = foreign exchange; GFC = global financial crisis.

level of hedging demand for a sharp depreciation against the dollar, have been more muted.[6] In addition, the wider cross-currency basis—a measure of dollar funding liquidity stress (Figure 2.4, panel 5)—was more short-lived. These developments were likely a result of

- The rapid establishment of central bank swap line facilities and bond repo facilities for foreign central banks by the Federal Reserve and the European Central Bank.[7]
- Structural shifts in the operation of FX markets since the global financial crisis (Schrimpf and Sushko 2019),[8] including increased turnover in emerging market currencies and electronic trading and a larger set of market-making institutions.

11. Unlike FX markets, local bond markets became more stressed and triggered policy responses in the form of asset purchase programs. A notable aspect is the increase in the risk premiums of long-end government bonds relative to short-end bonds and onshore swap rates (Figure 2.4, panel 6). Despite the positive impact of asset purchase programs on market conditions (see next subsection), stress levels have been more elevated, likely as a result of

- High local bond supply risks that weigh on yields through risk premiums.
- Weak foreign flows to local bond markets through May 2020, which had a negative impact on liquidity.
- Relatively limited depth of local currency government bond markets. Unlike FX markets, local bonds are still traded largely domestically, and market depth has not matched higher foreign participation, which could induce volatility (see Chapter 3 of the April 2020 GFSR). In countries with a shallower domestic investor base (see "Looking Ahead: Trade-offs of Asset Purchase Programs" section), domestic banks are the sole liquidity providers in times of stress.

Domestic Asset Purchases Eventually Helped Reduce Market Stress

12. The announcement of asset purchase programs in the second half of March did not have an immediate impact on local stress indices, given that global financial conditions were very tight and market conditions were hampered by illiquidity, strong risk aversion, and fiscal concerns (Figure 2.5, panel 1).[9] However as external conditions started to improve in April and countries stepped up implementation of asset purchase programs, country-level local stress indices showed

[6]In fact, during the early stages of the shock in February, the depreciation pressures in emerging markets were more acute against the euro, likely because of unwinding of euro-funded carry trades relative to high-yield currencies, such as the Russian ruble and the Mexican peso.

[7]The IMF flexible credit lines for Chile and Peru in the second quarter of 2020, and the renewal of the flexible credit line for Colombia, also boosted confidence and provided insurance against downside risks.

[8]Another structural shift worth noting is the shift toward more flexible exchange rate regimes since the 2008 global financial crisis (for example, in Russia).

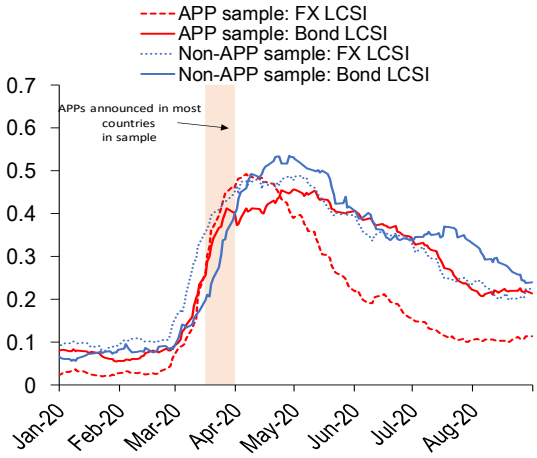
[9] This is in line with developments in the United States, where the Federal Reserve's March 15 announcement of additional US Treasury purchases did not relieve market stress.

some improvement and differentiation.[10] A large part of the improvement was seen in market liquidity measures, such as bid-offer spreads and a reduction in intraday volatility. Yet term premiums in some local bond markets remain elevated as investors are facing bond supply risks over a longer horizon given the uncertainty of pandemic-related government financing requirements.

Figure 2.5. Bond Stress and Asset Purchase Programs in Emerging Market Economies

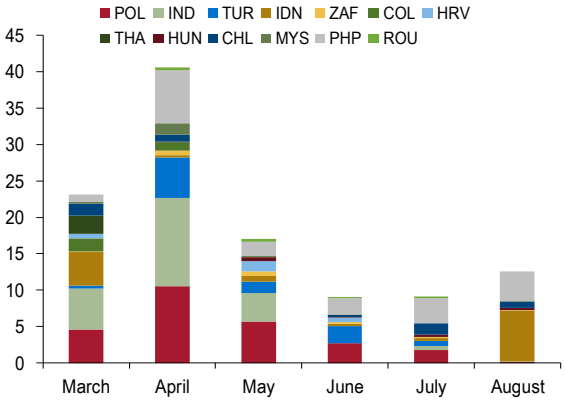
Stress has eased somewhat faster for countries with asset purchase programs than for those that do not have them.

1. Local Stress Indices (LSIs): APP versus Non-APP Economies



Emerging market asset purchases rose significantly in March and April but have moderated recently.

2. Asset Purchases by Major EM Central Banks (Billions of US dollars)



Sources: Bloomberg Finance L.P.; Haver Analytics; JPMorgan Chase and Co.; national authorities; and IMF calculations.
Note: Non-APP economies are Brazil, Chile, China, Mexico, Peru, and Russia. Indonesia purchases use data on gross holdings. Data labels in panel 2 use International Organization for Standardization (ISO) country codes. APP = asset purchase program; EM = emerging market; FX = foreign exchange; LCSI = local currency stress index.

13. Evaluating the effectiveness of asset purchase programs with respect to their stated goal of improving market conditions is complex, and more work is needed. Asset purchase programs helped reduce market stress, eventually, and several factors contributed to this reduction. The size of announced asset purchase programs in emerging markets has been small overall (except in Chile, Indonesia, Philippines and Poland) and short-lived, as is evident in the slowdown of asset purchases since May for most countries (Figure 2.5, panel 2). In addition, announcements and implementations of asset purchase programs can affect market conditions differently, and the lack of local currency bond inflows had a negative impact on market liquidity, especially in markets with a large foreign presence. The introduction of asset purchase programs at the height of the crisis is likely to have served as a useful circuit breaker, preventing further escalation of stress. Purchases of government bonds and other assets signaled that emerging market central banks were ready to stand as buyer of last resort (Arslan, Drehmann, and Hofmann 2020).

[10] Figure 2.5 panel 1 aggregates countries that have different characteristics, which could be the main driver of the results rather than APPs. Online Annex 2.1 presents event studies around the asset purchase announcements that show country-level developments.

Moreover, the empirical analysis presented below suggests that asset purchase program announcements had a positive impact on yields on the announcement date and several days beyond, even after controlling for external factors. Nevertheless, large-scale APPs, especially when open-ended, carry risks and may negate their initial effectiveness.

Domestic Asset Purchases Lowered Bond Yields and Had Little Effect on Currencies

14. Event studies show that asset purchase program announcements[11] had a significant immediate impact on asset prices and helped turn sentiment around.[12] Financial conditions were tightening going into the announcements but were inflected following the announcements, with a corresponding sharp reduction in government bond yields (Figure 2.6, panel 1) and term premiums (Figure 2.6, panel 2), but with relatively limited impact on currencies (Figure 2.6, panel 3). The reaction seen in intraday data for selected countries—to control for the effect of global and exogenous factors on end-of-day levels—shows a similar trend, with declining government bond yields but relatively less impact on currencies (Figure 2.6, panel 4; Arslan, Drehmann, and Hofmann 2020).

15. This section discusses empirical analysis of the effect of domestic asset purchase program announcements on local currency government bond yields.[13] The model controls for policy rate cuts by emerging market central banks and global factors, such as the VIX and the VIX rate of change and asset purchase program announcements by the Federal Reserve. The analysis uses daily data from 13 emerging market economies from January to mid-May 2020 and controls for unobserved country-specific factors using country fixed effects (see Online Annex 2.1). The analysis is based on the local projections method (Jordà 2005; Teulings and Zubanov 2014), which capture the full dynamics of sovereign bond yields in the aftermath of the announcements by central banks.[14] The dependent variable is the cumulative change in bond yields, and the main variable of interest is the indicator for the dates of asset purchase program announcements (Figure 2.7). A challenge in this analysis is to isolate the impact of asset purchase program announcements on bond yields from the effect of policy rate cuts and announcements by the Federal Reserve around the same time. To that end, two empirical specifications are presented to account for the direct effect of the additional asset purchase announcement by the Federal Reserve (Figure 2.7, panels 1, 3, and 5) and the VIX as a proxy for global risk appetite (Figure 2.7, panels 2, 4, and 6). Both specifications control for domestic policy rates.

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[11]The size of the announced programs may also have influenced the market reaction, although it is not considered (in line with the literature) given the lack of consistency across announcements and divergent market expectations.

[12] Results in this section draw upon Drakopoulos and others (forthcoming).

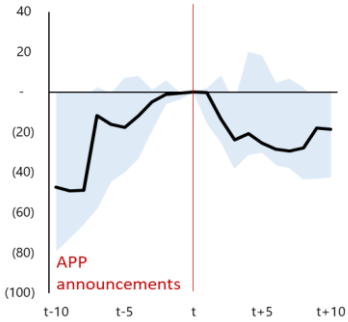
[13] Drakopoulos and others (forthcoming) discusses also the effect of APPs on equity markets.

[14]Evaluation of the effectiveness of asset purchases by the Federal Reserve uses the surprise announcement of 10-year equivalents on term premiums, but such an approach is beyond the scope of the analysis here.

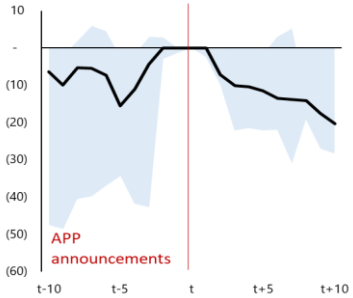
Figure 2.6. Market Reaction to Domestic Asset Purchase Program Announcements

Event studies around emerging market asset purchase program announcements show a significant change following the event, including a decline in sovereign bond yields and a decline in term premiums, but a relatively small and short-lived impact on EM currencies.

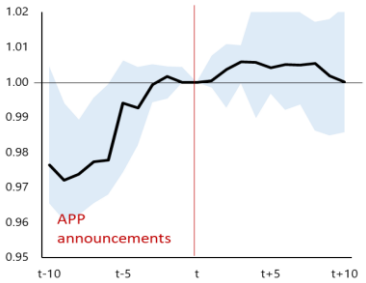
1. EM 10-Year Government Bond Yields (Indexed at 0 on *t*=0; basis points; days on *x*-axis)



2. EM 5-Year ACM Term Premiums (Indexed at 0 on *t*=0; basis points; days on *x*-axis)

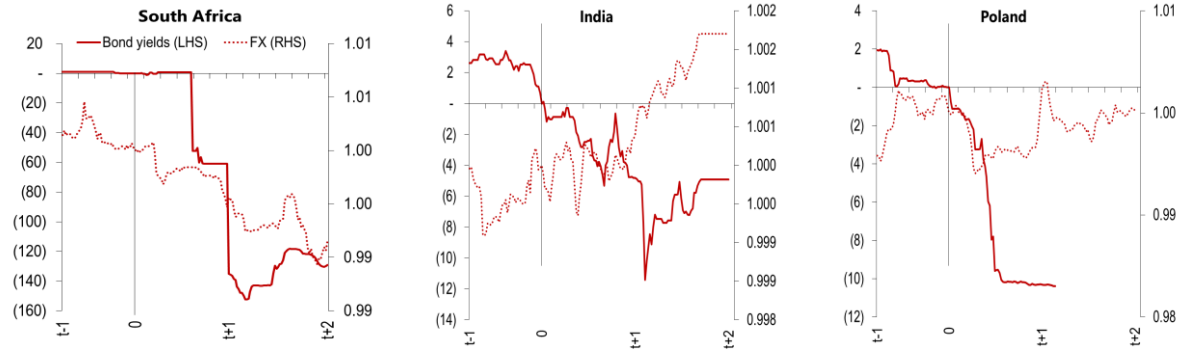


3. EM Currencies (Indexed at 1 on *t*=0; days on *x*-axis)



Intraday price reaction showed a similar trend, with government yields reacting very sharply, but relatively limited impact on emerging market currencies.

4. Intraday Asset Price Movement on the Days of Asset Purchase Program Announcements for Selected EMs (Change in basis points on left scale; indexed foreign exchange performance on right scale; hours passed on the *x*-axis)



Sources: Bloomberg Finance L.P.; Bank for International Settlements; BNP Paribas; national authorities; and IMF staff calculations.
Note: In panel 2, term premium calculations are based on the methodology detailed in Adrian, Crump, and Moench (2013). In panels 3 and 4, a declining trend in the foreign exchange lines implies an appreciation of the local currency versus the US dollar. In panels 1–3, the black line denotes the median across our sample, while the blue range highlights the interquartile range across the events. The sample comprises Chile, Colombia, Hungary, India, Indonesia, Malaysia, the Philippines, Poland, South Africa, and Turkey (across a total of 16 dates). ACM = Adrian, Crump, and Moench (2013); APP = asset purchase program; EM = emerging market; FX = foreign exchangeLHS = left scale; RHS = right scale.

16. Both specifications find that emerging market central bank asset purchase program announcements reduce long-end bond yields in a significant and persistent way (Figure 2.7, panels 1 and 2), even controlling for the Federal Reserve asset purchase program announcement (Figure 2.7, panel 1) or the change in global risk appetite (Figure 2.7, panel 2). The size of the impact of domestic asset purchase program announcements on yields ranges from 20 to 60 basis points and is statistically significant within one standard error confidence interval. The size of the effect is in the range of Arslan, Drehmann, and Hofmann (2020) and Hartley and Rebucci (2020). By contrast, in both specifications, domestic rate cuts do not appear to have a significant

effect on yields, controlling for other factors, such as asset purchase programs[15] (Figure 2.7, panels 5 and 6).

Figure 2.7. Asset Purchase Program Announcements and Sovereign Bond Yields

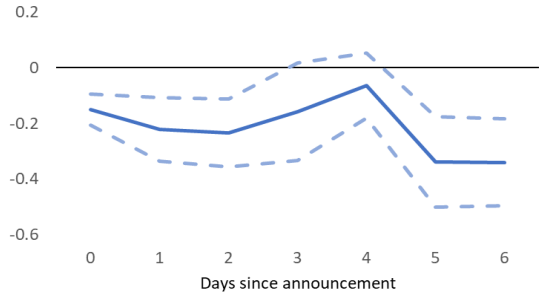
Panels 1, 3, and 5 show the impulse response functions to APP announcements by emerging market central banks, controlling for Federal Reserve actions and emerging market rate cuts.

Panels 2, 4, and 6 show the impulse response functions of APP announcements by emerging market central banks, controlling for the VIX as a proxy for global risk appetite and emerging market rate cuts.

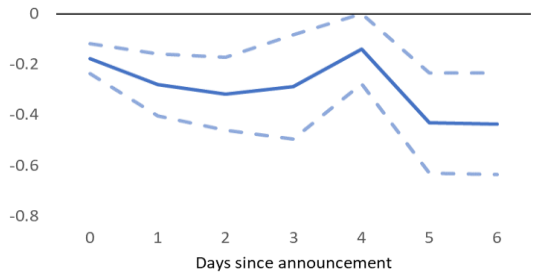
Specification 1: **Effect of Variable X on Bond Yields (Percentage point change in yield)**

Specification 2: **Effect of Variable Y on Bond Yields (Percentage point change in yield)**

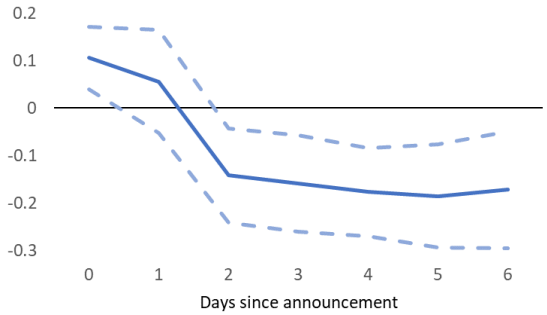
1. X = Domestic APP Announcements



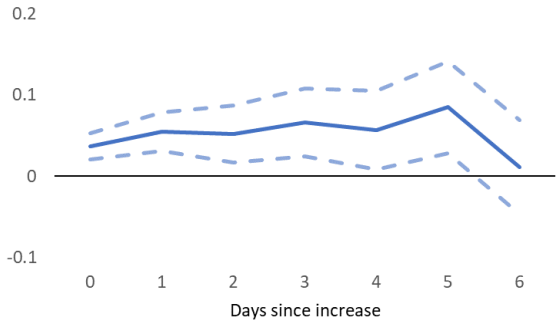
2. Y= Domestic APP Announcements



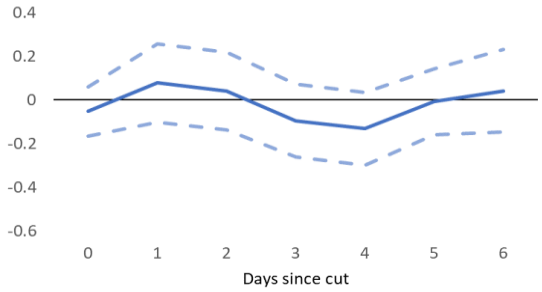
3. X = Federal Reserve Quantitative Easing Announcement



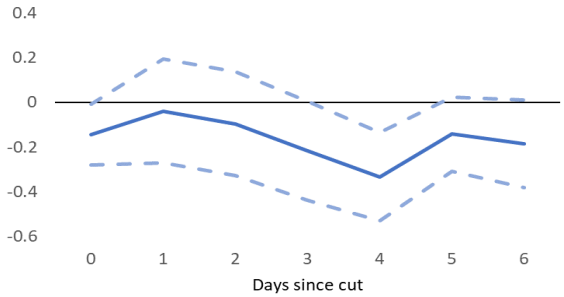
4. Y = Ten Point VIX Increase



5. X = 1 Percentage Point Domestic Policy Rate Cut



6. Y = 1 Percentage Point Domestic Policy Rate Cut



Source: IMF staff calculations.

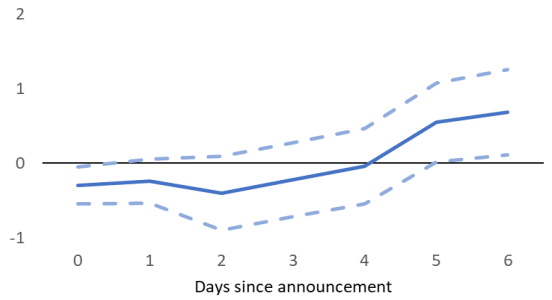
Note: Results are based on the local projections method (Jordà 2005; Teulings and Zubanov 2014) using panel data from 13 emerging markets at daily frequency from the beginning of January to mid-May 2020. The dependent variable is the cumulative change (in percentage points) in local currency sovereign bond yields. The first specification controls for the APP announcement by the Federal Reserve and domestic rate cuts (panels 1, 3, and 5). The second specification controls for the Chicago Board Options Exchange Volatility Index (VIX) and domestic rate cuts (panels 2, 4, and 6). Country fixed effects are included in both specifications. Coefficient estimates are reported with one standard error confidence interval. The *x*-axes represent the number of trading days following each episode. See Online Annex 2.1 for more details. APP = asset purchase program.

[15] This might also reflect that the rate cuts were already priced in or that risk premiums remained high.

17. The improvement in external conditions also had a significant and persistent impact on lowering long-end yields. Both the Federal Reserve asset purchase program announcement on March 23 (Figure 2.7, panel 3) and the improvement in global risk appetite (Figure 2.7, panel 4) had a positive effect on decreasing yields, reflecting the sensitivity of domestic bond yields to global factors (April 2020 GFSR). This is also consistent with the finding by Beirne, Renzhi, and Sugandi (2020) of evidence of spillovers to emerging market bond yields from quantitative easing by central banks in advanced economies (Chapter 1). The magnitudes of the effect of the asset purchase program announcements by emerging market central banks and the Federal Reserve are broadly similar.

18. Announcements of asset purchase programs did not lead to a significant depreciation of emerging market currencies (Figure 2.8), in line with intraday event studies (Figure 2.6, panel 4). This may reflect the relatively small size of the programs and the fact that the purchases were sterilized in many cases. Furthermore, the restoration of stability and the decisive actions taken by advanced and emerging market central banks may have also contributed to investor confidence and reversal of the earlier considerable FX sell-off.

Figure 2.8. Asset Purchase Program Announcements and Domestic Currencies
(Percent change in currency)



Source: IMF staff calculations.
Note: Results are based on the local projections method (Jordà 2005; Teulings and Zubanov 2014) using panel data from 13 emerging markets at daily frequency from the beginning of January to mid-May 2020. The dependent variable is the cumulative change (in percent) in the value of domestic currencies vis-à-vis the US dollar. The specification controls for the asset purchase program (APP) announcement by the Federal Reserve and domestic rate cuts, as well as country fixed effects. Coefficient estimates are reported with a one standard error confidence interval. The *x*-axis shows the number of trading days following each episode. See Online Annex 2.1 for more details.

Looking Ahead: Trade-offs of Asset Purchase Programs

19. The experience with emerging market asset purchase programs has been largely positive so far, though further expansion of duration or size could create risks and thus warrant an ongoing evaluation of risks. APPs had a catalyzing effect on lowering local currency government bond yields without indications of immediate risks to financial stability. In some cases, purchases may have intermediated an orderly exit of investors from local currency bond markets, but this was likely done in the interest of preserving investor confidence and avoiding more costly and widespread market disruptions. Central bank communication and benign market perception in terms of the scope, timing, and temporary nature of these programs were essential in containing perceived risks of fiscal dominance that would likely have led to higher bond yields and weaker currencies.

20. Beyond the pandemic, this positive experience may motivate more emerging market central banks to consider unconventional monetary policy as a key additional part of their policy

toolkit, especially where conventional policy space becomes limited.[16] APPs may be suitable for countries constrained by their own effective lower bound, with inflation expectations steady, where the concern over capital outflows and FX depreciation is low or where the domestic absorption capacity of new bond supply is limited (Figure 2.9, panel 1). The goal of an APP in such cases is to exert control over the medium- to long-end of the yield curve (even when policy rates remain substantially above zero) to lower government financing costs and to temporarily ease pressure on domestic investors when there is increased issuance or foreign investor outflows. There are important caveats when it comes to this goal however. Longer-term yields play a less central role in most emerging market economies than they do in advanced economies. Similarly, the fragilities behind higher short-term rates are likely to limit the scope for attempts to lower longer-term yields.

21. Policymakers should consider both the benefits and potential significant costs of APPs with respect to monetary policy and financial stability. If large-scale APPs are used beyond the current pandemic-related extraordinary situation, the following risks could arise, especially for open-ended programs (see Figure 2.9, panels 2–4 which highlight select country characteristics to take into consideration while deploying APPs, and Hofman and Kamber, forthcoming):

- ***Institutional and central bank credibility may be weakened.*** Credible monetary policy frameworks and sound governance are prerequisites for effective unconventional policy actions such as APPs. Early evidence suggests that APPs by central banks with higher institutional quality tended to have a greater reduction of their bond local stress index, introduced earlier in this chapter. Increased balance sheet exposure to long-term debt may raise concerns about the central bank's ability to raise interest rates when conditions warrant or to achieve price stability.
- ***Asset purchases may invite concerns about fiscal dominance.*** When central banks become buyers of last resort, with large-scale and open-ended APPs in economies with weak monetary and fiscal policy frameworks, it can lead to fiscal dominance, resulting in higher risk premiums and steeper government bond yield curves. Increased balance sheet exposure to long-term debt may raise concerns about a central bank's ability to raise interest rates when conditions warrant to achieve price stability.
- ***APPs may intensify capital outflow pressure, especially in countries with weaker fundamentals.*** Expectations of large-scale APPs may put downward pressure on long-term yields and foreign exchange rates, putting capital flows at risk, especially during risk-off periods, when emerging market assets are seen as risky. Investors may decide to rebalance their portfolios more decisively if APPs result in an excessive gap between domestic and peer-group risk premiums.
- ***The lasting presence of central banks as buyers in the local currency bond market may distort market dynamics.*** APPs can end up substantially increasing the role of the

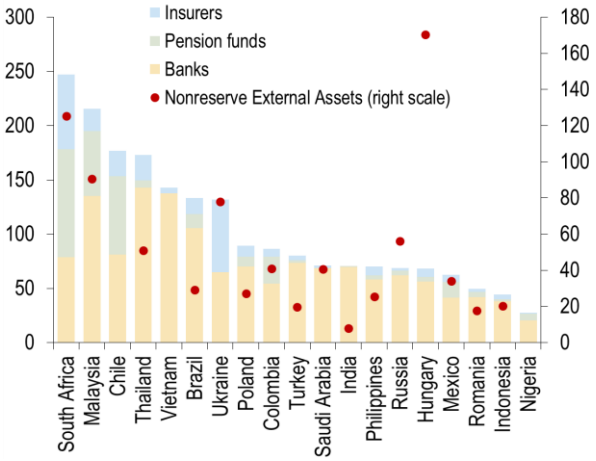
[16]For a deeper discussion of the use of unconventional monetary policy in emerging market economies see Hofman and Kamber (forthcoming).

central bank as a market maker, impairing the price discovery process, especially in primary markets,[17] and the development of the financial market. Considerations should also be given to the effect of APPs on collateral availability in the banking system and its impact on the policy rate transmission (Singh and Goel 2019) as well as possible overvaluation of assets.

Figure 2.9. Considerations for Asset Purchase Programs

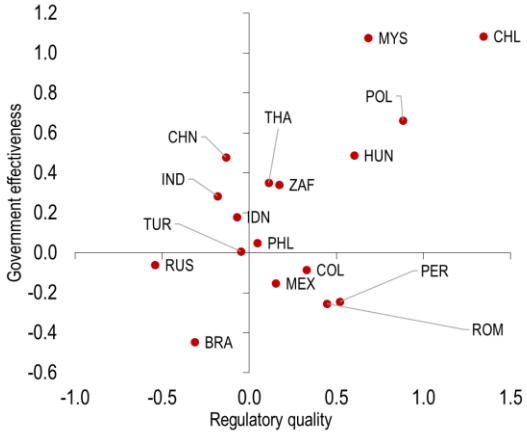
The depth of the domestic investor base and its ability to repatriate foreign assets may affect the need for APPs.

1. Domestic Institutional Investor Base (Assets, percent of GDP, latest data available)



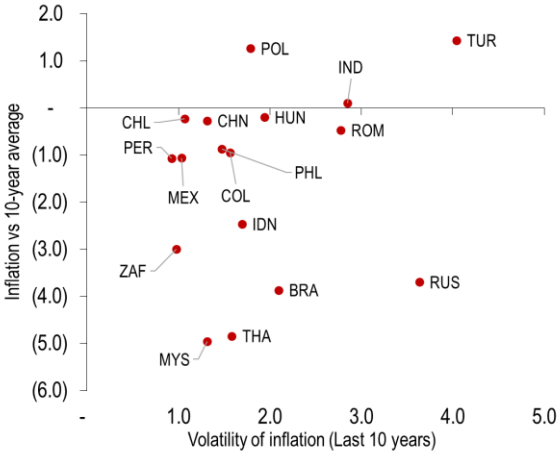
Institutional credibility may be weakened during large-scale APPs, with effectiveness potentially contingent on institutional characteristics.

2. Regulatory Quality and Government Effectiveness (Indices)



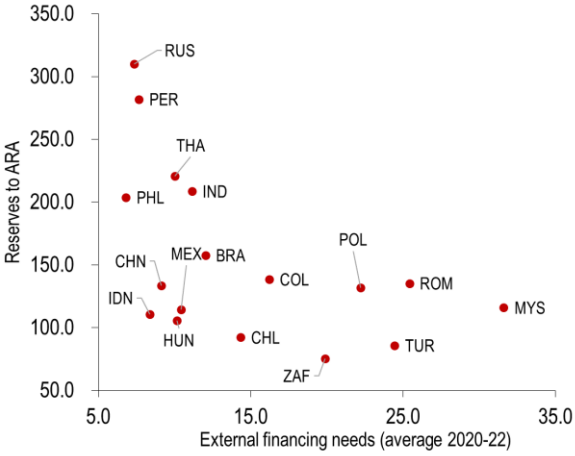
APPs may raise concerns about the central bank's ability to raise rates to maintain price stability in the future.

3. Inflation: Volatility versus Deviation from Trend (Percent)



APPs may intensify capital outflow pressure, especially in countries with weaker external fundamentals.

4. External Financing Needs versus Reserves (Index and percent of GDP)



Sources: Bloomberg Finance L.P.; Haver Analytics; World Bank; and IMF staff calculations.
Note: Data labels in panels 2, 3, and 4 use International Organization for Standardization (ISO) country codes. APP = asset purchase program; ARA = assessing reserve adequacy; RHS = right scale.

[17] In markets that lack financial depth and where the government has large crisis-related short-term financing needs, there may be scope for the central bank to provide, under conditions, temporary support directly to the primary market to assist with the absorption of large issuance.

22. The motivation, effectiveness, and associated risks of APPs vary considerably from country to country and depend on additional considerations, such as the structure and liquidity of capital markets, availability of high-quality domestic assets, extent of foreign investor participation, and level of development of the financial sector (Hofman and Kamber, forthcoming). Focused use of APPs as part of the crisis toolkit of emerging and frontier market economy central banks with credible monetary policy frameworks and good governance has a role to play. But continuing evaluation is needed as more data become available on the effectiveness of unconventional monetary policy in emerging markets, especially for open-ended programs.

The Role of the Official Sector in Frontier Market Economy Debt Restructuring

23. Frontier market economies[18] entered the pandemic in a vulnerable position, with a number of countries already deemed to be at a high risk of debt distress (see the October 2019 GFSR) and with relatively little policy space compared with major emerging market economies. The postcrisis period of easy global financial conditions allowed frontier market economies to raise unprecedented amounts of capital in private markets (Figure 2.10, panel 1), all the while increasing their rollover risk. Markets reflected these concerns, as bond spreads rose to their highest level since the global financial crisis during the initial stages of the market sell-off, but spreads have since erased a significant amount of the widening (Figure 2.10, panel 2).

24. To help alleviate the strains facing frontier economies, the Group of Twenty (G20) announced the Debt Service Suspension Initiative (DSSI) to temporarily ease the financing constraints of the poorest countries by freeing up scarce money that they can use to mitigate the human and economic impact of the COVID-19 crisis. While some countries have already begun to participate in the initiative, some have been reluctant, in part because of fears of loss of market access (see also Chapter 1).

25. Markets, however, are not pricing in a significant risk from DSSI participation, despite concerns about possible negative actions by the credit rating agencies. On average, spreads of countries eligible for the DSSI have outperformed those of other frontier countries, even excluding countries eligible for the DSSI that do not intend to participate (Figure 2.10, panel 3). This outperformance could be a result of investor expectations that the initiative can allow these countries to better weather the outcome of the pandemic. For now, the initiative is providing relief primarily through a moratorium on bilateral debt, while private sector groups have begun assessing potential ways to assist. Even though the DSSI helps free up scarce money to mitigate the human and economic impact of COVID-19, once the impact of the pandemic becomes clearer, official sector relief may prove insufficient for some countries. Overall, bilateral creditors represent about one-third of debt payments owed by countries eligible for the DSSI over the

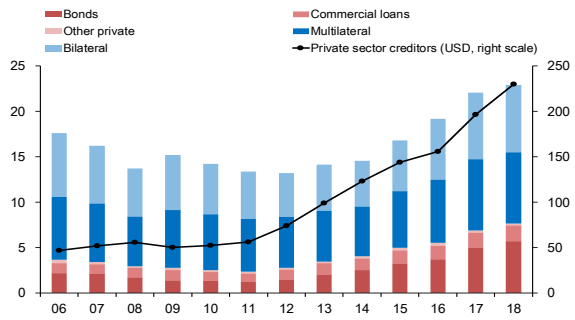
[18] Frontier economies comprise 43 countries, defined in Online Annex 2.1, the bulk of which are part of JP Morgan's Next Generation Markets Index.

next few years (Figure 2.10, panel 4). For many countries, private sector debt represents a much larger proportion of their external debt (Figure 2.10, panel 5).

Figure 2.10. Frontier Economies Have a Challenging Road Ahead

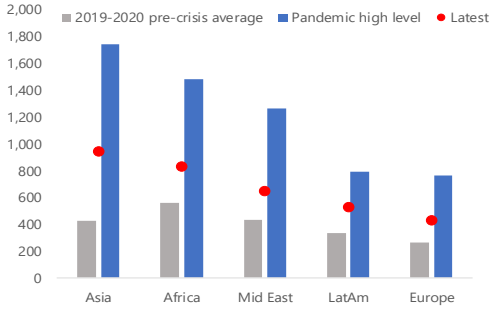
Frontier economies have become more dependent on private sector debt in recent years.

1. Frontier Market Debt: Creditor Composition (Percent of GDP and billions of US dollars)



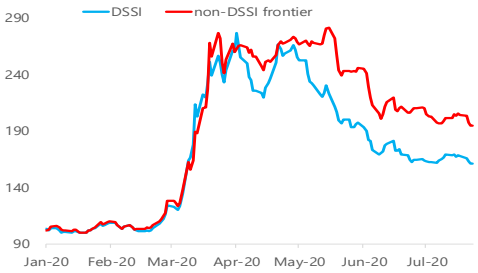
Market conditions have deteriorated substantially since the onset of the COVID-19 crisis.

2. Bond Spreads of Frontier Economies during the COVID-19 Crisis (Basis points)



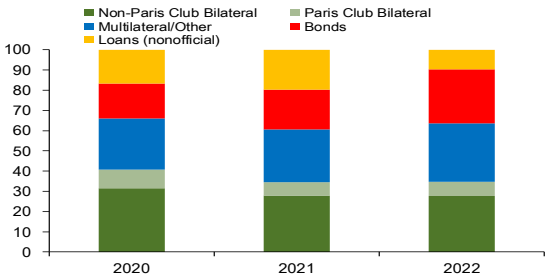
Countries eligible for the Debt Service Suspension Initiative have outperformed somewhat since April.

3. Normalized Spreads of Frontier Market Economies (Index; January 1, 2020 = 100)



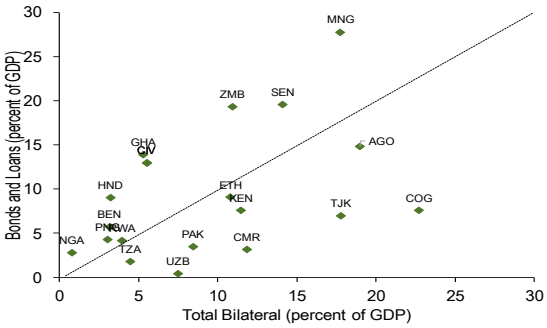
Bilateral creditors, primarily non–Paris Club creditors, represent about a third of debt payments over the next few years …

4. Debt Service Payments by Creditor for a Sample of Frontier Economies (Share of total, percent)



… but for several countries, private creditor debt is significant.

5. Debt Outstanding: Private versus Official (External debt outstanding, percent of GDP)



Sources: Bloomberg Finance L.P.; Bond Radar; JPMorgan Chase and Co; World Bank; and IMF staff estimates.
Note: Panel 3 is based on a rolling panel regression of the log of spread versus ratings, the Chicago Board Options Exchange Volatility Index (VIX), and an interaction term. Latam = Latin America. Panel 4 comprises a sample of 22 frontier economies that are DSSI-eligible. The broad frontier universe comprises 43 countries defined in Online Annex 2.1. Panel 5 uses data from the World Bank as of 2018. Data labels in panel 5 use International Organization for Standardization (ISO) country codes.

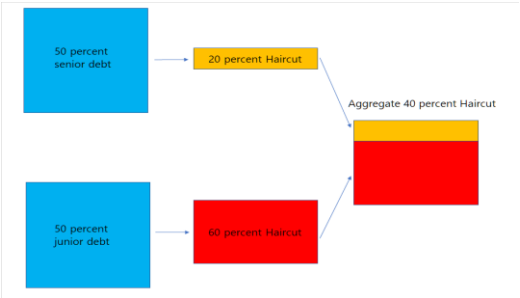
26. For some countries, to achieve a necessary debt reduction, it is impractical for only the official sector to proactively alleviate the debt burden. Putting off debt relief by private sector creditors may eventually call for a larger debt write-down, which could disproportionately affect private sector debt. Markets appear to perceive already that, in a default situation, they would be forced to take a larger haircut than bilateral creditors would.

27. Why this would drive higher spreads can be demonstrated in a hypothetical example. If a country requires a given overall debt reduction to make its debt sustainable, but one class of creditors is treated as senior, other creditors would need to take a greater burden (Figure 2.11, panel 1). Panel 2 of Figure 2.11 demonstrates the impact that different levels of senior debt would have on a bond's spreads at given levels of expected probability of default.[19] A country whose debt is entirely "junior," or private sector, would have a much lower spread than one for which half of the debt is considered senior. This spread impact increases as the credit quality decreases (higher expected default probability). A model for sovereign bond spreads shows that investors do expect a larger haircut than bilateral creditors.[20] The results of the model are consistent with investors expecting that bilateral creditors would take a 30 percent haircut in the case of a country that requires an overall 40 percent haircut. This analysis does not consider differences among groups of bilateral creditors or whether the impact is less or more for Paris Club creditors. Considering that bilateral loans are often extended at concessional levels, or at times when countries are not able to consistently borrow from private markets, it is not surprising that they would be expected to receive more favorable treatment in a restructuring scenario.

Figure 2.11. Large Shares of Senior Creditors Could Lead to Higher Spreads

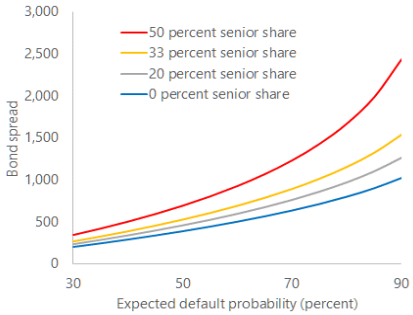
If one class of creditors receives smaller haircuts, other creditors need to bear a greater burden.

1. Stylized Example of Issuer Requiring a Total 40 Percent Haircut with Debt Evenly Split



Investors pricing a larger required haircut in case of default could meaningfully impact spreads.

2. Bond Spread under Different Recovery Assumptions and Expectations of Default (Basis points)



Source: IMF staff calculations.
Note: Panel 2 assumes a bond with an 8 percent coupon and 10-year maturity. It assumes that an overall debt reduction of 40 percent is required, with senior debt holders accepting only a 20 percent haircut.

[19] This stylized exercise assumes a 10-year bond with an 8 percent coupon.

[20] This is based on a variant of the EM hard currency bond valuation model introduced in the October 2019 GFSR. The domestic fundamentals include expectations for growth and inflation, current account balance, external debt, net issuance of foreign currency government debt, and foreign currency reserves. External factors include global risk-appetite and growth expectations. The model was modified to also include the share of bilateral and multilateral debt.

Policies for Recovery and Resilience

28. Unprecedented policy measures put in place by advanced and emerging market policymakers after the onset of the COVID-19 pandemic averted the worst outcome and helped stabilize domestic financial conditions. Emerging market central banks actively used available and new tools to soften the blow from the spike in global risk aversion and intervened to smooth excess volatility of domestic currencies and contain the spillovers of tighter global financial conditions to domestic financial conditions. Appropriate use of FX intervention, macroprudential policies, and capital flow management measures in the face of shocks, such as the global pandemic, can contribute to financial stability and enhance monetary policy autonomy.

29. This chapter finds that global factors played a more important role in driving currencies than FX intervention did, probably because of the global nature of the shock. The short-lived FX intervention is consistent with using the currency as a key shock absorber when other vulnerabilities are in check. Countries with shallow FX markets may experience macroeconomic destabilization after such shocks, and FX interventions to lean against market illiquidity to mute excessive volatility can be appropriate (IMF 2020a).

30. Most notably, many emerging and frontier market central banks for the first time embarked on APPs to ensure the smooth functioning of bond markets and provide accommodation in an environment of very low policy rates. The apparent success in helping reduce bond yields without risking financial stability so far prompts the question of whether APPs should be part of the emerging and frontier market policy toolkit in the future.

31. For *central banks with APPs in progress*, transparency and clear communication[21] are crucial to minimize risks to their credibility—especially in countries with weaker institutional frameworks. In most cases, APPs should be limited in time and scale and should be linked to clear objectives. This chapter's findings suggest that APPs can be helpful, but that they are not a panacea to improve market conditions. They appear to be more effective when used jointly as part of a broader macroeconomic policy package.

32. *Central banks considering APPs for the first time or seeking to restart them* should design programs that aim to affect segments of the yield curve that are an effective pricing benchmark to maximize transmission to the real economy. Purchases should preferably be made in secondary markets, as purchases in the primary market or at below market rates can disrupt the price discovery process and invite fiscal dominance. APPs should take into consideration the efficacy of the portfolio balance channel and whether investors have the ability to allocate their investments in other domestic assets, such as corporate or covered bonds. In the absence of such domestic alternatives, both foreign and domestic investors might choose to exit their country position altogether, which could increase the sensitivity of the exchange rate to APP policies. The resultant currency depreciation in countries with large currency mismatches in

[21] Communication and transparency regarding the cost of sterilization can also be crucial, especially in cases where central bank purchases are done below market rates. Large sterilization costs can increase concerns about central bank losses and monetary policy independence.

private sector balance sheets could at least partly offset the stimulatory effect of APP policies by tightening overall financial conditions. The experience of advanced economy central banks with exit strategy plans may also be important for emerging market central banks to consider, particularly when the size of the program is meaningful.

33. APPs should be designed so as not to become barriers to the development of domestic capital markets or the growth of a stable and diversified local investor base. In countries with relatively small bond markets, large and prolonged APPs could end up substantially increasing the role of the central bank as a market maker in bond markets, impairing the price discovery process and financial market development. Specific measures for further local market development include (1) developing efficient money market frameworks; (2) strengthening primary market practices to enhance transparency and predictability of issuance; (3) bolstering market liquidity, including the use of repo facilities for local dealers in times of stress; and (4) developing a robust market infrastructure, including local clearing and settlement and other services (as detailed in IMF 2020b). For countries with adequate preparation in terms of legal barriers and market infrastructure, authorities should work toward enabling settlement and clearance of local currency debt in international capital markets so that domestic markets can benefit from access to wider liquidity pools.

34. Frontier market economies with unsustainable debt dynamics, limited market access, and high external financing requirements should preemptively and cooperatively seek debt resolution with their creditors. Countries that maintain market access at reasonable rates should decrease rollover risks as part of their debt management strategy.

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ONLINE ANNEX 2.1. TECHNICAL NOTE[1]

A. Local Stress Index for Emerging Market Economies

1. This GFSR introduces a Local Stress Index (LSI) that measures market conditions across local government bond and FX markets in emerging market economies[2]. The index allows real-time market monitoring through a single indicator while also providing direct attribution to drivers of market stress. Unlike broader financial condition indices (FCI) that capture price of risk or cost of funding for the whole economy, the LSI focuses on stress within a specific market and therefore can be a component of a broader FCI measure. The index construction methodology is based on Hollo, Kremer and Lo Luca (2012) and Garcia-de-Andoain, Kremer (2018) can be summarized into following steps:

- **Variable selection**: The index aims to focus on variables that have low correlation in normal market conditions but can become increasingly correlated at times of stress. These measures include bid/ask spreads, intraday price movements and risk premia measures. For bond market LSI non-resident flows (scaled by the size of the bond market) and trading volumes are also included where available. This way, when large non-resident outflows or abnormal trading volumes co-occur with a jump in risk-premia or widening of bid-ask spreads, the index will pick up a signal about a potential market imbalance. While most countries will have an overlap in terms of relevant market variables, the selection is driven by country market specific considerations. For example, in countries with limited currency convertibility, the currency basis would be substituted with deliverable vs non-deliverable forward spreads. A limitation with some of these variables in the index is that structural shifts that may have occurred over the years cannot be controlled. For example, cross currency basis or risk reversals were more scarcely traded products 10-15 years and their information content from those periods might be more limited. The list of main variables included in the Local Stress Index is presented in Online Annex Figure 2.1.1, panel 1)

- **Variable transformation:** Each variable is transformed in a way that ensures a homogenous distribution and scale by applying the probability integral transform (PIT) to a cumulative distribution function (CDF). More precisely, variable X is transformed to an indicator Z, with r being the ranking number and n the total sample size, as follows:

$$Z_{n+T} = F_{n+T}(X_{n+T}) := \begin{cases} \frac{r}{n+T} \; for \;\; X_{[r]} \leq X_{[n+T]} < X_{[r+1]} \;, r = 1,2, \dots n-1, \dots n+T-1 \\ 1 \; for \; X_{n+T} \;\; \geq X_{[n+T]} \end{cases}$$

[1] This section is prepared by Dimitris Drakopoulos and Dmitri Petrov.

[2] The index is calculated on 16 Countries: Brazil Chile, China Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey.

Although this transformation generates some information loss by not maintaining the cardinal scale, it can improve them robustness over more common transformations that rely on the sample mean and standard deviation (e.g., z-score). For example, given variables such as bid-offer, or implied volatility follow highly asymmetric distributions, standardization and aggregation based on z-scores becomes problematic. Such variables are more likely to produce observations with large deviations from the mean (i.e. large z-scores) which can in turn dominate the dynamics of the aggregated index during times of stress. Additionally, the z-scores values are not comparable across variables given differences in the original distribution function of each variable. After the initial calibration period (2005–2009), the PIT uses "real time" samples and is therefore not subject to large revisions due to outliers that can change the mean and the standard deviation of the historical sample.

- **Index aggregation**: The variable aggregation relies on time-varying correlation between the transformed variables. Thus, the index increases more in a situation where stress prevails in several indicators at the same time. The index is aggregated using the following formula:

$$LSI_t = (w \; o \; Z_t) \; C_t \; (w \; o \; Z_t)'$$

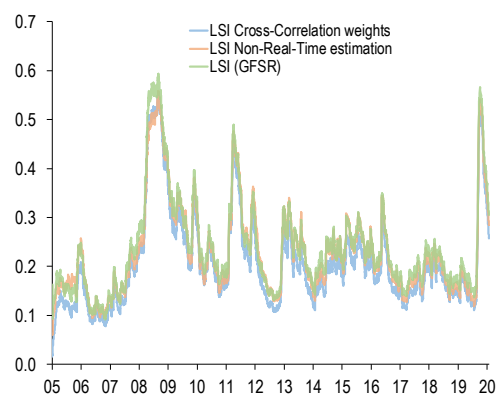
where o denotes the Hadamard-product, w is a vector of equal indicator weights, Z is a vector of transformed variables and C is a three-dimensional array of time-varying correlations. The time-varying correlation is estimated based on an exponentially weighted moving average. In order to simplify interpretation of EM wide index, equal weights are used when aggregating the country indices. The difference between equal weights and aggregation using cross country correlations is small (Online Annex Figure 2.1.1 panel 2). Alternative aggregations based on principal component analysis (PCA) yield were also tested. Under the PCA approach the first principal component tends to capture more global risk-events rather than idiosyncratic events and weighs the index more towards the exchange rate LSI. Furthermore, PCA suffers both from sub-sample robustness and is more sensitive to changes in index composition over time.

Online Annex Figure 2.1.1. LSI Methodology

1. Variables in LSI

Exchange Rate LSI	Local Bonds LSI
FX bid-ask spread	Bond bid-ask spread
Realized volatility	Realized volatility
Currency basis	Bond asset swap
Convertibility basis	Term-premium estimate
Implied Volatility	Non-resident flows
Risk-reversal ratio	Bond volume deviations

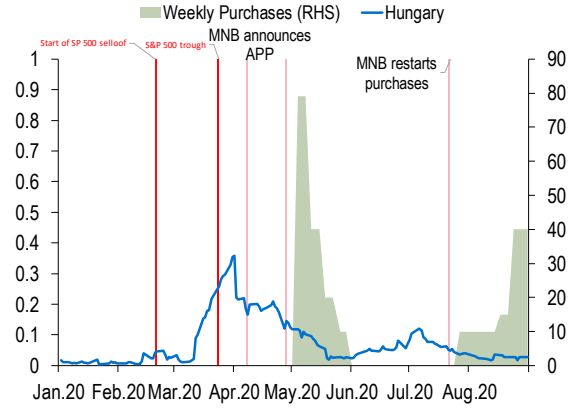
2. Alternative Aggregations of EM LSI (index)



Online Annex Figure 2.1.2. Country Event Studies for Bond LSI

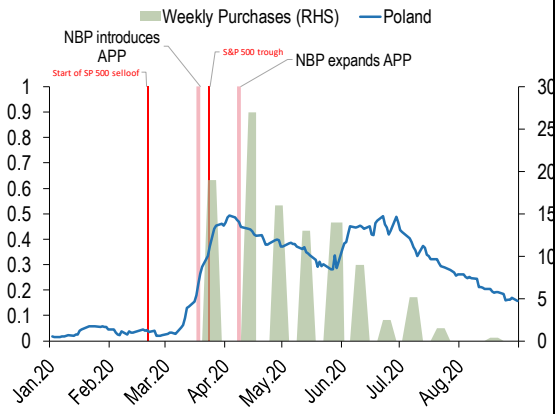
In Hungary, purchases in May seem to have had a large impact. MNB decided to step up its program in the summer as conditions deteriorated again.

1. Hungary Bond LSI and Purchases (Index and local currency)



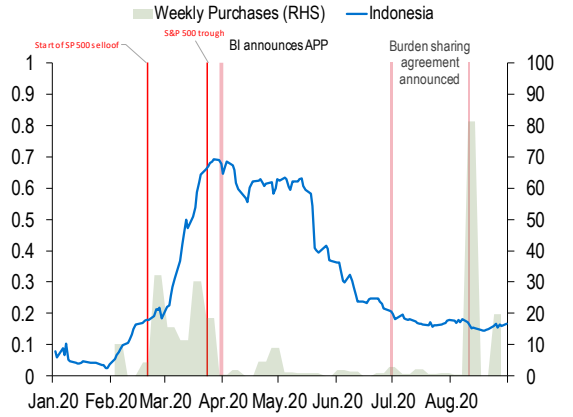
In Poland, large purchases in April were combined with a step up in issuance. Purchases tapered off as conditions improved in June, but trading volumes have remained low.

2. Poland Bond LSI and Purchases (Index and local currency)



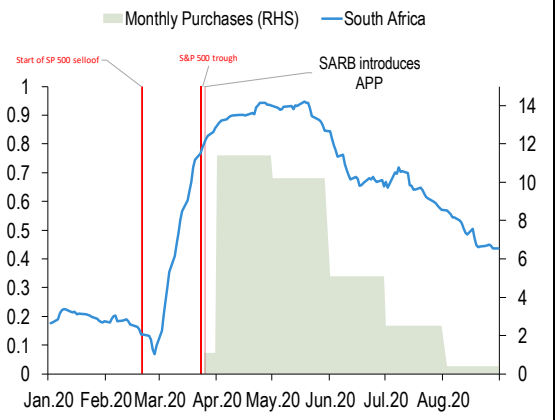
Indonesia purchases were also frontloaded and combined with large issuance. Conditions improved further following the burden sharing agreement in July.

3. Indonesia Bond LSI and Purchases (Index and local currency)



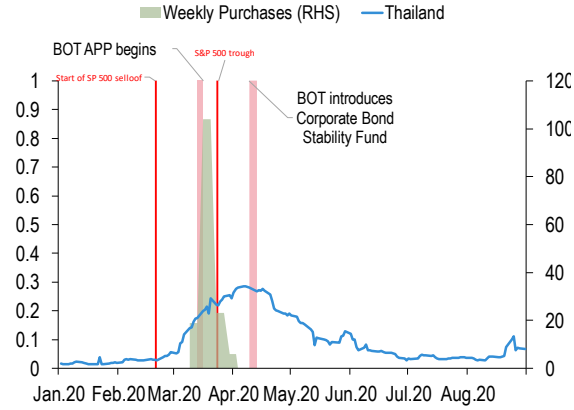
In South Africa APP has been relative limited in size and the market has remained concerned with increased issuance.

4. South Africa Bond LSI and Purchases (Index and local currency)



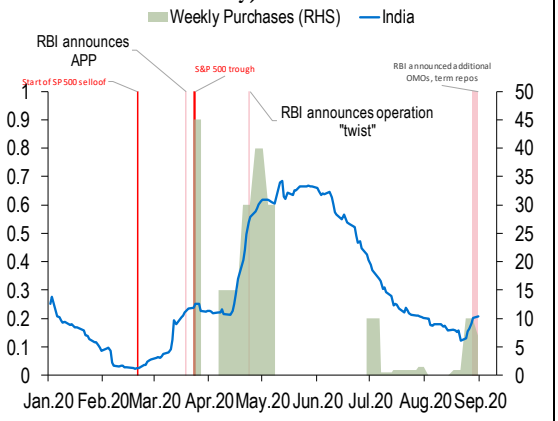
Thailand saw a swift improvement in the LCSI, despite halting its APP in early April …

5. Thailand Bond LSI and Purchases (Index and local currency)



… while in India the improvement remained limited until RBI announced its simultaneous sell/buy curve operations.

6. India Bond LSI and Purchases (Index and local currency)



Sources: Bloomberg Finance L.P.; Country Central Banks; and IMF Calculations.

B. Measuring the Drivers of FX Surprises during the COVID-19 Sell-Off and the Role of FX Intervention[3]

2. The goal of the empirical analysis is to shed light on the drivers of exchange rate movements in emerging markets and examine the role of domestic policies as well as global factors.

The specification is as follows:

$$\Delta\, Currency_{c,m} = \alpha_1 Domestic\ policies_{c,m} + \alpha_2 Global\ factors_m + \alpha_3 Domestic\ policies_{c,m}\ x\ Global\ factors_m + \alpha_4 X_{c,m} + \mu_c + e_{c,m}$$

where c and m stand for country and month, respectively. The variable details are as follows:

- **The** dependent variable $\Delta\, Currency_{c,m}$ is how much the value of domestic currency ended up higher than the forward value a month ago.[4] Specifically, it is calculated as the (negative of) percentage difference between the realized value of domestic currency (vis-a-vis the US dollar) at the end of month m and the value of one-month forward contract at the end of month $m-1$, normalized by the latter. The negative difference of the percentage value is used, hence the variable represents the percentage gain of the domestic currency above the forward one month before. Note that the analysis is also employed using simple exchange rate movements and the results are broadly consistent.
- $\boldsymbol{Domestic}\ policies_{c,m}$ include the intervention in the FX market (FXI) in a given month, and the domestic policy rate at the end of the month.
    - FXI[5] is calculated as the valuation adjusted changes in the stock of reserves for any central bank. The estimates include reserve operation in spot as well as the derivative markets. Operations in the derivative markets do not represent a drag on the reserve stock but are included in the calculations to estimate the true size of the intervention. These estimates do not adjust for FX bond sales/purchases, so may represent a partial picture in a few cases (e.g., Mexico). The variables to construct the FXI are adopted from Bloomberg, IIF, the dataset by Adler and others (forthcoming). The indicator is scaled by the actual stock of reserves.
    - The data on domestic policy rates are obtained from Bloomberg.

[3] This section is prepared by Rohit Goel and Can Sever.

[4] This variable is expected to proxy the surprise movement in the exchange rates, given what was priced in the forward contracts. This assumes interest rate parity holds true, though the authors acknowledge that spot rates can deviate from forward rates for an extended period of time.

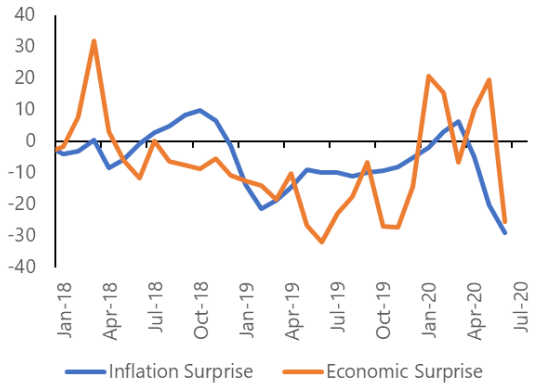
[5] Some results might be overstated due to potential endogeneity issues.

- $\boldsymbol{Global}\ factors_{c,m}$ consists of the effective Federal Fund rate at the end of each month, and the VIX Index averaged over the month. The data on global factors are from Bloomberg.
- In addition, the four interactions between these domestic policies and global factors are added to take a potential interplay between those into account.
- $X_{c,m}$ represent macroeoconomic control variables, namely the surprise indices on economic activity and inflation. The indices represent the high frequency data releases vs the analyst expectations of these data releases and are meant to proxy the macroeconomic surprises. These indices are sourced from Citi and Bloomberg (see Online Annex Figure 2.1.3).
- Finally, country fixed effects (μ_c) are included to account for any time-invariant country specific factors that may potentially lead to a bias in the estimation. Standard errors are robust.

Online Annex Figure 2.1.3. Macroeconomic Surprise Indices for Emerging Markets

Economic surprises have been mixed, while inflation surprises have remained to the downside for EMs.

1. Macroeconomic Surprise Indices for EMs (Index)



Sources: Bloomberg Finance L.P.; and Citigroup.
Note: The chart shows the aggregate trend; the analysis takes country level indices into account.

3. Two separate regressions are employed to analyze the effect of domestic policies and global factors on domestic currencies during:

- the period of COVID-19 (GFSR Figure 2.2, panel 3); and the first column of Online Annex Table 2.1.1, and
- the 2015 China sell-off episode (GFSR Figure 2.2, panel 4); and the second column of Online Annex Table 2.1.1.

4. The sample consists of 14 emerging market economies in both cases: Argentina, Brazil, Chile, China, Colombia, India, Indonesia, Mexico, Malaysia, Philippines, Russia, Thailand, Turkey, and South Africa.

5. The period of the analysis is from January to May of 2020 in the former, whereas it is from April 2015 to February 2016 in the latter.

6. Note that the coefficient estimates are reported with 2 standard error confidence intervals in the panels in GFSR Figure 2.4.

7. As a robustness check, China is removed from the panel but the results are still consistently robust.

Online Annex Table 2.1.1. Effects of Domestic and Global Factors on FX Surprises

Variable	2020 COVID-19	2015 EM Sell-Off
FX Intervention	-0.813	2.196***
	(0.991)	(0.706)
Domestic Policy Rate	-0.376	1.788**
	(0.309)	(0.813)
VIX	-0.525***	7.928
	(0.100)	(6.748)
Federal Fund Rate	-9.659***	0.203
	(1.634)	(0.125)
FX Intervention x VIX	0.012	-0.165***
	(0.019)	(0.048)
FX Intervention x Federal Fund Rate	0.206	4.095
	(0.430)	(2.485)
Domestic Policy Rate x VIX	0.008*	-0.007
	(0.004)	(0.012)
Domestic Policy Rate x Federal Fund Rate	0.160**	-2.219**
	(0.064)	(1.011)
Controls	Yes	Yes
Country Fixed Effects	Yes	Yes
R-Squared	0.635	0.244
Countries	14	14
Observation	68	142

Source: IMF Staff Calculations.
Note: *** p<0.01, ** p<0.05, * p<0.1

Reference

Adler, Gustavo, Kyun Suk Chang, Rui C. Mano, and Yuting Shao. Forthcoming. "Foreign Exchange Intervention: A Data Set of Public Data and Proxies." International Monetary Fund, Washington, DC.

C. Impact of Asset Purchase Announcements on Local Currency Yields and Currencies[6]

8. The staff analysis empirically explores the effect of domestic APP announcements by EM central banks on local currency sovereign bond yields and currencies, after controlling for domestic policy rate cuts and global factors, such as the QE announcement by the Federal Reserve or the VIX index. The estimation aims to capture both the size and the persistence of the impact. For this purpose, local projections method -proposed by Jorda (2005) with the extension introduced by Teulings and Zubanov (2014)- is used in the empirical analysis. This allows to capture the full dynamics of sovereign bond yields in the aftermath of the announcements by central banks. The specification is as follows:

$$\Delta Y_{c,t-1\rightarrow t+p} = \sum_{r=0}^{p} \alpha_1^{p,r}\, APP\ announcement_{c,t+p-r} + \sum_{r=0}^{p} \alpha_2^{p,r}\, Global\ factor_{t+p-r} + \sum_{r=0}^{p} \alpha_3^{p,r}\, \Delta Policy\ rate_{c,t+p-r} + \sum_{l=1}^{4} \Omega_1^{l}\, APP\ announcement_{c,t-l} + \sum_{l=1}^{4} \Omega_2^{l}\, Global\ factor_{t-l} + \sum_{l=1}^{4} \Omega_3^{l}\, \Delta Policy\ rate_{c,t-l} + \mu_c + e_{c,t+p} \quad (1)$$

where *c* stands for country and *t* stands for day. The dependent variable $\Delta Y_{c,t-1\rightarrow t+p}$ is the cumulative change in yield (in percentage points) from *t-1* to *t+p*. Data on yields for 10-year local currency sovereign bonds is adopted from Bloomberg.

- The variable $APP\ announcement_c$ is a dummy variable which takes 1 in the dates of APP announcements by EM central banks, and 0 otherwise.[7] Data on the dates for APP announcements are mainly based on the IMF staff research and are illustrated in Table 2 below.
- The variable $Global\ factor_t$ is either (i) a dummy variable indicating the date for QE announcement by the Federal Reserve (GFSR Figure 2.7, panels 1, 3, and 5) to capture the direct effect of that on yields, or (ii) the VIX index (GFSR Figure 2.7, panels 2, 4, and 6) as a proxy for global risk appetite. The dummy variable for the date of the QE announcement by the Federal Reserve is assigned 1 on March 23. The VIX index is adopted from the Federal Reserve Bank of St. Louis database.
- The third explanatory variable is the percentage points decrease in policy rates ($\Delta Policy\ rate_c$) and adopted from Bloomberg.

[6] This section is prepared by Dimitris Drakopoulos, Rohit Goel, and Can Sever.

[7] This dummy variable approach comes with a caveat, since it ignores the size, duration or specific nature of each announcement – which can potentially affect the consequences of the announcement. However, it is not straightforward to apply this analysis using size or other features of APP announcements, since they have not been very clearly defined in many cases.

9. Four lags of all explanatory variables are included. However, using lower/higher number of lags does not affect the results. Any bias from unobserved country-specific features are absorbed by country fixed effects (μ_c). This is important in the estimation, since those characteristics such as pre-COVID-19 market conditions, institutional capacity, policy credibility, accountability or central bank independence may yield a bias in the results by altering the impact of APP announcements.[8] Standard errors are robust.[9]

10. The analysis uses panel data at daily frequency from 13 emerging market economies (Online Annex Table 2.1.2). The period of the analysis is from the beginning of January 2020 to the mid-May 2020.

11. The coefficient estimates $\alpha_i^{p,p}$ with *i=1,2,3* are reported for 6 trading days (for *p=0,…,6*) in the aftermath of each action, and the day of the event (day 0). Thus, the estimation is able to capture the full dynamics the response of yields and hence the persistent of the effect. One standard error confidence interval is also reported. Panels 1, 3, and 5 in GFSR Figure 2.7 report results when the date for QE announcement by the Federal Reserve is used in equation (1) as the global factor, whereas panels 2,4,6 document the response with the VIX index instead.

Impact of Asset Purchase Announcements on Emerging Market Currencies

12. For calculating the impact of asset purchase announcements on EM currencies, the same empirical set-up as described above is used. The result is documented in GFSR Figure 2.8. The dependent variable $\Delta Y_{c,t-1\rightarrow t+p}$ in that case is the cumulative change in the exchange rate vis-à-vis the US dollar. The $Global\ factor_t$ is the QE announcement by the Federal Reserve in that analysis.

Dates for APP Announcements by EM Central Banks

13. As mentioned earlier, the dates for APP announcements by EM central banks are mainly based on the IMF staff research, but the staff also benefit from Arslan and others (2020) and Hartley and Rebucci (2020). Online Annex Table 2.1.2 illustrates the list of 13 EMs in the sample together with APP announcement dates.

Further Checks

14. The exact dates used in our analysis are mostly consistent with those used in both Arslan and others (2020) and Hartley and Rebucci (2020). However, to alleviate any concerns, the following robustness steps are taken:

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[8] For instance, see the discussions in Arslan and others (2020), Çakmaklı and others (2020), and Hartley and Rebucci (2020).

[9] Results are virtually the same if standard errors are clustered at the country-level.

- In the case that APP announcement dates in a country in the sample may be particularly problematic, the staff re-run the test in (1) with 12 EMs dropping one EM at a time. Throughout those regressions, results in GFSR Figure 2.7 stay similar. Hence, results are not driven by any of the countries in the sample.

- There exist APP announcement dates which are close to each other, e.g., in India. This may lead to a concern on that the specification may generate biased results in such cases given the length of the analysis (i.e., 6-day period in the aftermath of each event). For instance, following an announcement at day *t*, the cumulative change in the yield at day *t+6* would reflect the impact of the announcement at day *t*, and if any, the second announcement within this period. However, by applying the extension by Teulings and Zubanov (2014), the analysis controls for the forward values of the announcements dates to isolate the effect of each day, and hence, alleviates a potentially downward bias arising from such consecutive announcements in the sample.[10] However, when the only first announcement date is adopted for each country with multiple announcement dates, results remain very similar.

- A large set of alternative combinations/identifications of domestic APP announcement dates is employed, and results are similar.

Online Annex Table 2.1.2. Dates for APP Announcements[1]

Country	Date	Country	Date
Chile	March 16, April 8	Philippines	March 24, April 10
Colombia	March 23	Poland	March 17, April 8
Hungary	March 24, April 7, April 28	Romania	March 20
India	March 18, March 20, April 23	South Africa	March 25
Indonesia	April 1	Thailand	March 19, March 23, April 7
Korea	March 19, March 25, April 9	Turkey	March 31, April 17
Mexico	April 21		

Source: IMF staff.
[1] The sample is expanded to include non-emerging markets (e.g., South Korea) as well as announcements not considered as APP (e.g., Mexico). The results remain robust if individual countries are removed.

[10] See Teulings and Zubanov (2014) for a detailed discussion.

D. Central Bank Policy Responses

15. In figure 2.1, panel 3, central bank policy options are counted only once. For example, more than one rate cut is counted as one action. Policy actions are reported by IMF country desk economists.

16. The emerging market sample included in Figure 2.1, panel 3 includes 50 central banks: Angola, Ghana, Kenya, Mozambique, Nigeria, South Africa, Zambia, China, India, Indonesia, Sri Lanka, Lao, PDR, Malaysia, Mongolia, Philippines, Thailand, Vietnam, Papua New Guinea, Bulgaria, Georgia, Albania, Hungary, Croatia, Poland, Romania, Russian Federation, Turkey, Ukraine, Serbia, Algeria, Egypt, Kazakhstan, Morocco, Pakistan, Tunisia, Uzbekistan, Saudi Arabia, Brazil, Chile, Colombia, Mexico, Peru, Dominican Republic, Jamaica, Guatemala, Paraguay, Serbia, Bank of Central African States (BEAC), Central Bank of West Africa States (BCEAO).

Online Annex Box 2.1. The Monetary Policy Response to the COVID-19 Crisis in China

China did not experience the financial market stress seen in other emerging markets, but authorities have still faced challenges in maintaining supportive financial conditions. After cutting policy interest rates and deploying measures to directly increase bank credit, the People's Bank of China (PBOC) scaled back expectations for further interest rate reductions in May, leading to a rebound in money and bond market yields. The policy shift came amid improving economic activity but also concerns about rising financial sector risks.

Bond yields fell in the first few months of the COVID-19 crisis as the PBOC injected liquidity and cut short-term and one-year policy rates by 30 basis points, with the latter the benchmark reference rate for most loans. Short-term interbank rates and one-year government bond yields fell much more sharply, declining as much as 180 and 100 basis points, respectively. The improvement in funding conditions, however, largely reversed after markets adjusted expectations of further policy rate cuts in May, sending corporate and longer-maturity government bond yields above pre–COVID-19 levels.

This episode highlights some of the complexities of interest rate transmission in China.

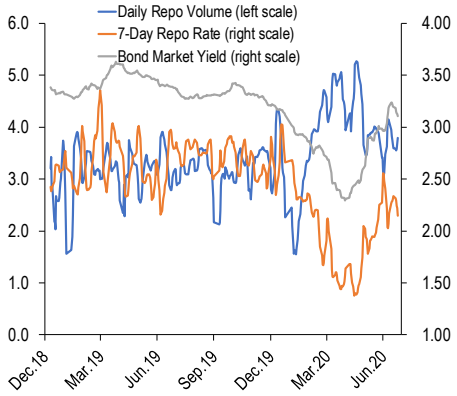
- Repo-funded bond market purchases play an important role in policy rate transmission in China's bond market but are procyclical and can create large swings in interest rates.[1] The large initial declines in short-term interbank and government bond rates this spring coincided with a sharp rise in interbank repo borrowing volumes, particularly by asset management products, suggesting that leveraged bond purchases amplified declines in interest rates (Figure 2.1.1, panel 1). When policy expectations shifted and short-term rates rose, leverage fell sharply, contributing to the subsequent sell-off in bonds.
- Short-term interbank interest rates have limited pass-through to bank funding costs. Banks primarily rely on regulated-rate deposits for funding, but deposit yields remain relatively sticky given competition from wealth management products and other less-regulated deposit alternatives using leverage and other risk-taking to offer significantly higher yields (Figure 2.1.1, panel 2). Falling interest rates led to surging flows into these products and limited the benefits to bank funding costs (Figure 2.1.1, panel 3).
- Yields on long-term government bonds fell by less than half as much as on short-term bonds, steepening the yield curve to a five-year high. The smaller reduction in long-term rates reflected surging issuance of such bonds amid rising government deficits but also the limited declines in funding costs for the large state-owned banks, which absorb the majority of this issuance. Historically, long-term bond yields rarely fall below these banks' marginal (nondeposit) funding cost (Figure 2.1.1, panel 4).

While lower interest rates supported the economy, they also posed risks to bank profits and added to financial vulnerabilities. For banks, limited downward flexibility in funding costs means that declines in the benchmark lending reference rate directly reduce profits and their ability to provide new financing, particularly for smaller banks. As mentioned, lower

Online Annex Figure 2.1.1. The Monetary Policy Response to the COVID-19 Crisis in China

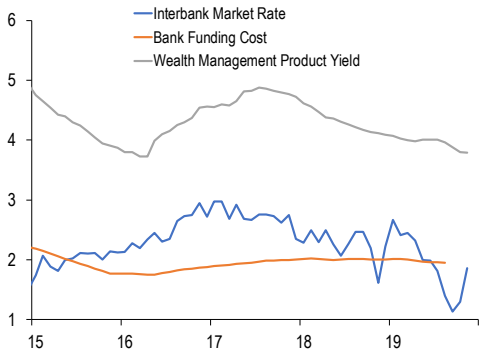
The surge in repo borrowing helped amplify initial declines in interest rates, but also contributed to the bond sell-off when investors later reduced leverage.

1. China: Daily Interbank Repo Trading Volume, Repo Rates, and Bond Prices (Trillions of renminbi, percent)



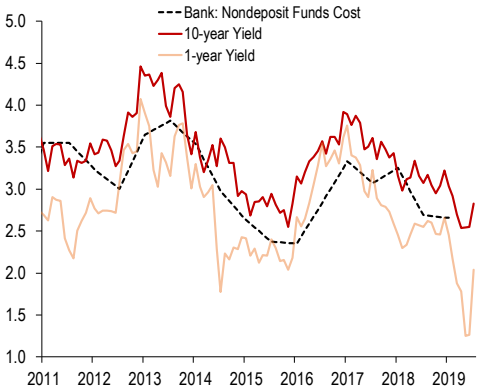
Falling interbank market rates provided relatively little pass-through to funding costs for key lenders such as banks and wealth management products.

2. China: Selected Monthly Interest Rates (Percent)



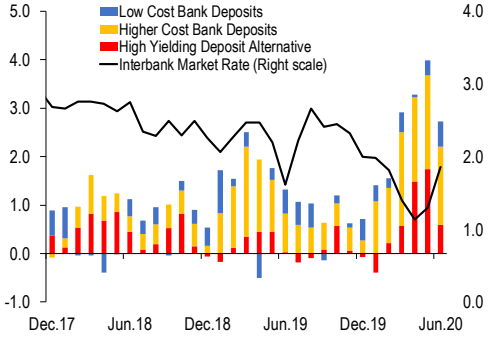
Short-term rates had a limited impact on long-term yields, which remain linked to banking sector funding costs …

3. China: Government Bond Yields and Banks' Nondeposit Cost of Funding



Deposit alternatives saw surging inflows as interest rates fell, suggesting that banks might see funding cost pressures from further cuts to policy rates.

4. China: Changes in Selected Financial System Liabilities and Interbank Rate (Trillions of renminbi; three-month moving averages)



Sources: Bloomberg Finance L.P.; CEIC; People's Bank of China; S&P Market Intelligence; and IMF staff calculations.
Note: In panel 1, bond market yield is Bloomberg Barclays China Aggregate Index, including government, financial, and corporate bonds, and seven-day repo rate is five-day moving average of the daily weighted average rate. In panel 2, the interbank market rate is the weighted average repo rate. Bank funding costs are based on weighted average disclosures from banks in China. In panel 3, bank funding cost data are based on financial disclosures from national state-owned-enterprise banks. In panel 4, low-cost deposits include demand and overseas deposits. Higher-cost deposits include time and other deposits. Deposit alternatives include bank off-balance-sheet wealth management products, structured deposits, and money market and bond funds.

Online Annex Box 2.1 *(concluded)*

interest rates also led to a rise in asset management sector vulnerabilities. Net money market borrowing volumes by investment products surged 55 percent during the first half of 2020 to RMB 130 trillion, increasing leverage and interconnectedness with the broader financial system.

In addition to lowering policy rates, authorities have used other policy tools to accelerate credit growth and support vulnerable borrowers. The PBOC has expanded its relending facilities (which provide low-cost funding for bank lending) to nearly RMB 2.2 trillion, targeted to micro and small businesses, the agricultural sector, and privately owned and manufacturing firms. Authorities have also used administrative tools to guide banks to increase lending and lower interest rates, particularly to these same borrower segments.

While providing additional support to the economy, credit support measures may be adding to nonfinancial sector vulnerabilities. China's combined household- and corporate-debt-to-GDP increased faster than in any other major country in the first quarter (see Figure 1.11, panel 2), against a backdrop of already very high nonfinancial sector debt servicing burdens. Anecdotal evidence also suggests that new credit is being used to fund stock market leverage and home purchases rather than investment.

Going forward, continuing to address interest rate transmission issues will allow authorities to increase the scope for traditional interest-rate-based monetary policy, easing debt servicing burdens and credit misallocation risks. Key policy priorities are still closing remaining prudential regulatory gaps, particularly in the asset management sector; phasing out benchmark deposit rates; and accelerating bond market development by improving hedging mechanisms and diversifying the investor base.

This author of this box is Henry Hoyle.

[1] Adrian, Hoyle, and Natalucci (2019) provide evidence of significant procyclicality between trading and funding liquidity in China's bond market, reflecting limited hedging mechanisms and other market structure features.

Online Annex Box 2.2. Capital Controls in Times of Crisis

Large and sudden capital outflows can pose significant policy challenges for emerging market and developing economies. According to the IMF's institutional view on the liberalization and management of capital flows, in the face of an imminent crisis, temporary capital controls may help prevent a free fall of the exchange rate, preserve foreign exchange reserves, and provide breathing space until other policy adjustments, including macro-financial adjustments, take effect. This box offers insight into the characteristics and effects of capital controls in times of crisis (Bouis and others, forthcoming).

Despite exceptionally large capital outflows within a short period, the COVID-19 crisis did not trigger widespread introduction of capital controls. Given a swift recovery of capital inflows aided by ultra-loose advanced economy monetary policy, unprecedented foreign exchange interventions, access to IMF financing, a drop in gross outflows, and concerns about losing sovereign bond index membership, only a few emerging market and developing economies tightened controls to limit capital flight; some eased inflow controls. Nonetheless, in past crises, countries occasionally adjusted controls to reduce capital outflows.[1] Understanding the design of such controls and their macroeconomic effects is crucial for their effective implementation during crises.

The bulk of economies maintain at least a few capital controls (Figure 2.2.1, panel 1). Although there has been a steady move toward removing controls in the past three decades, controls have been tightened more since the global financial crisis than before the crisis (Figure 2.2.1, panel 2).

Countries responding to crises with capital controls generally tighten restrictions on outflows or ease restrictions on inflows (Figure 2.2.1, panel 3). Outflow controls implemented in crises tend to be blunt and sticky; initially they are applied to several asset classes, prohibiting or setting limits on outflows, and they are fine-tuned later as experience is gained.[2] In contrast, easing of inflows is more often targeted and price-based.[3] Outflow controls are lifted after crises have subsided and usually last longer than expected (Figure 2.2.1, panel 4).

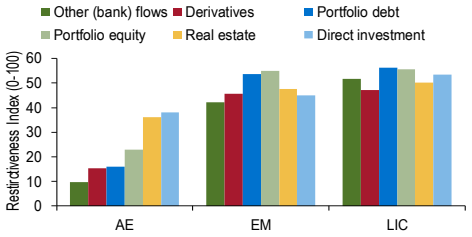
An analysis covering 27 advanced and emerging market and developing economies that experienced at least one crisis between 1995 and 2017 indicates that countries with more open capital accounts experience a significant drop in both capital inflows and outflows, unlike countries with more pervasive controls, which do not see a statistically significant effect of the crisis on capital flows (Figure 2.2.1, panel 5). However, the effectiveness of implementing capital controls to increase inflows or reduce outflows during crises cannot be firmly established because of difficulties in overcoming endogeneity issues in econometric analysis.

Online Annex Box 2.2 *(continued)*

Online Annex Figure 2.2.1. Capital Controls During Crises

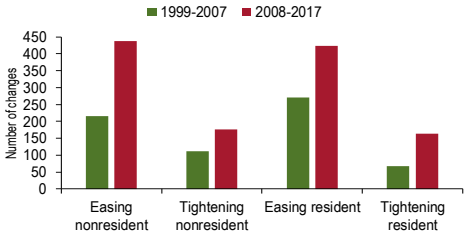
Capital controls are more prevalent in lower- and middle-income countries, but advanced economies also maintain some controls, particularly on inflows of foreign direct investment and real estate.[1]

1. Average Level of Restrictiveness, 2018



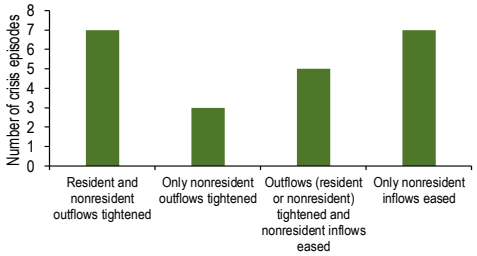
While countries continued to liberalize, more controls were tightened following the global financial crisis than earlier, in response to advanced economy unconventional monetary policy and possibly lessons learned during the crisis.

2. Number of Changes in Capital Controls (Sample of 40 countries)



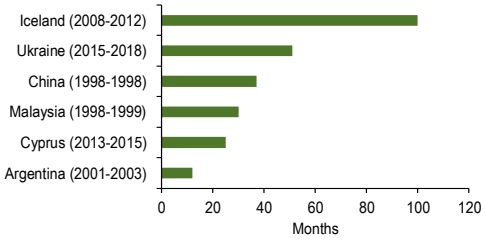
When responding with controls to crises, countries generally either tighten restrictions on outflows or ease restrictions on inflows.

3. Capital Controls during Crises by Type of Flow, 1995–2017



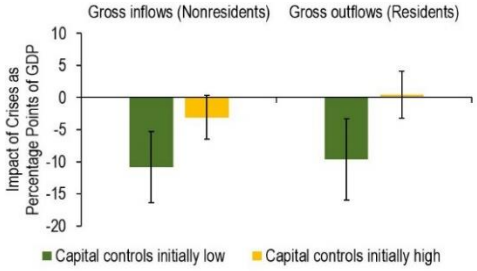
While crisis-related controls are usually intended only for a short time, they tend to remain in place for longer.[2]

4. Duration of Controls on Outflows by Nonresidents



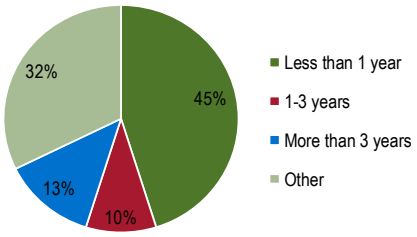
Countries with high preexisting capital controls do not suffer a statistically significant decline in capital flows during crises, unlike countries with more open capital accounts.

5. Estimated Impact of Crises on Gross Flows, According to Capital Account Openness (With 95-percent confidence interval)



Investors reallocate their investments from countries that introduce capital controls, but almost half of the surveyed investors would reinvest in the same country within a year of removal of controls.[3]

6. Period before Investors Report Resuming Investments after Removal of Controls



Sources: IMF; Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; survery of 31 investors; and authors' calculations.
Note: Crisis events are identified using the database developed by Laeven and Valencia (2018). AE = advanced economy; EM = emerging market; LIC = low-income country.

[1] In panel 1, the restrictiveness of transactions corresponding to each asset is measured by the number of transactions reported as controlled in the AREAER as a percentage of all transactions related to the asset class.

[2] In panel 4, the year of the start of the crisis (when the control was enacted) and the end year of the crisis, according to Laeven and Valencia (2018), are included in parentheses. The exceptionally long period in Iceland may be partially due to the collapse of the banking system, which was one of the biggest bankruptcies in history that had to be resolved within one of the smallest monetary systems in Europe.

[3] In panel 6, the results show responses to the question "How long [after the removal of a capital control in a country from which you have exited] would you wait before resuming investing in this country/market?" based on 31 responses from a variety of investors and market participants to a survey conducted in February 2020.

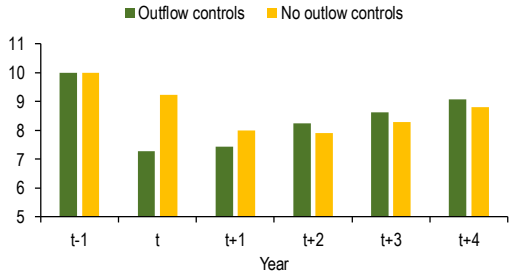
Online Annex Box 2.2 *(concluded)*

Capital controls implemented in crises do not seem to be associated with a lasting adverse effect on sovereign ratings (Figure 2.2.2, panels 1 and 2). Countries implementing controls experience a larger drop in ratings but recover them similarly to countries without controls. A survey also indicates that, although capital controls matter to investors, investors appear to be generally forgiving. The majority of those surveyed would demand higher risk premiums to invest in a country with capital controls and would reallocate their investment from a country that introduces capital controls, but almost half of them would reinvest in the same country within a year of removal of controls (Figure 2.2.1, panel 6).

Figure 2.2.2. Impact of Outflow Controls on Sovereign Ratings

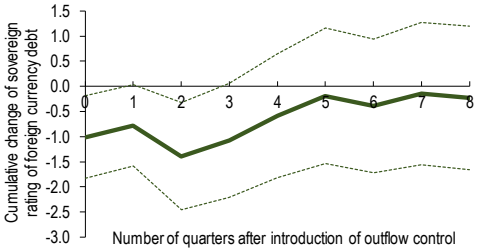
Countries tightening or introducing outflow controls experience a downgrade of their rating three times as large as the downgrade of countries not implementing controls (on average by almost 3 points) in the year the controls are implemented, but they recover their rating as fast as countries that do not use controls ...[1]

1. Average Rating of Countries with and without Outflow Controls Introduced in Crisis Year *t*[2]



… as confirmed by econometric analysis showing the absence of a significant long-term effect of outflow controls on the rating.

2. Cumulative Change of Sovereign Rating in Response to Introduction of Outflow Controls (With 90-percent confidence interval)[3]



Sources: Bloomberg Finance L.P.; IMF, FFA and Annual Report on Exchange Arrangements and Exchange Restrictions databases; and authors' calculations.
Note: Crisis events are identified using the database developed by Laeven and Valencia (2018).
[1] This could reflect a negative signal of the controls sent to the market and/or the fact that countries using these types of controls are experiencing more severe crises.
[2] Panel 1 shows the average Standard and Poor's rating of sovereign debt in foreign currency (ranging from 1 for default to 22 for AAA), rebased at value 10 the year before the crisis year *t*. For countries experiencing a crisis but not introducing outflow controls, *t* is the year the crisis starts; for countries implementing outflow controls in response to a crisis, *t* is the year the controls were introduced.
[3] Panel 2 shows the estimated dynamic effect of the introduction of controls on sovereign debt rating using the local projection approach (see Bouis and others 2020 for details).

This box was prepared by Romain Bouis, Annamaria Kokenyne, Manuel Perez, and Umang Rawat.

[1] For the purposes of this box, capital controls are capital flow management measures that discriminate based on residency. Outflow controls restrict the purchase of foreign assets by a country's residents or the liquidation and repatriation of investment of nonresidents' local assets.
[2] Based on a sample of 41 advanced economies and emerging market and developing economies that have experienced a crisis since 1995, according to Laeven and Valencia (2018).
[3] Price-based controls include taxes, levies, and unremunerated reserve requirements.

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