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EMDE Central Bank Interventions during COVID-19 to Support Market Functioning

Kelly Eckhold, Julia Faltermeier, Darryl King, Istvan Mak, and
Dmitri Petrov

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WORKING PAPER

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Monetary and Capital Markets Department

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Prepared by Kelly Eckhold, Julia Faltermeier, Darryl King, Istvan Mak, Dmitri Petrov*Authorized for distribution by Christopher Erceg
May 2024

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ABSTRACT: This paper examines emerging market and developing economy (EMDE) central bank interventions to maintain financial stability during the COVID-19 pandemic. Through empirical analysis and case study reviews, it identifies lessons for designing future programs to address challenges faced in EMDEs, including less-developed financial markets and lower levels of institutional credibility. The focus is on the functioning of the financial markets that are key to maintaining financial stability—money, securities, and FX funding markets. Several lessons emerge, including: (i) objectives should be well-specified and communicated to facilitate eventual exit; (ii) intervention triggers should prioritize liquidity metrics over prices; (iii) actions should be sufficiently large to address market dysfunction; (iv) the risks of fiscal dominance and moral hazard should be minimized; and (v) program design should incentivize self-liquidation by appropriate pricing or through short-term operations that quickly liquidate. While interventions may increase risks to central bank balance sheets, potentially challenging policy solvency and operational independence, a well-designed framework can significantly mitigate these risks.

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Prepared by Kelly Eckhold, Julia Faltermeier, Darryl King, Istvan Mak, and
Dmitri Petrov¹

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Glossary

AE	advanced economy
BCCh	Central Bank of Chile
BI	Bank Indonesia
bps	basis points
BSP	Bangko Sentral ng Filipinas
BTr	Bureau of the Treasury
CIP	covered interest parity
EM	emerging market
EMDE	emerging market and developing economy
FX	foreign exchange
GDP	gross domestic product
IDR	Indonesian rupiah
IMF	International Monetary Fund
INR	Indian rupee
LTRO	Long-Term Refinancing Operation
NBFI	Non-Bank Financial Institution
NBP	National Bank of Poland
OMO	Open Market Operation
PhiREF	Philippine Interbank Reference Rate
PLN	Polish zloty
QE	quantitative easing
RBI	Reserve Bank of India
SAGB	South African Government Bond Market
SARB	South African Reserve Bank
SOMO	Structural Open Market Operation
TLTRO	Targeted Long-Term Refinancing Operation
UK	United Kingdom
US	United States
USD	United States dollar
VIX	Chicago Board Option Exchange Volatility Index
ZAR	South African rand

Executive Summary

The COVID-19 shock undermined the functioning of financial markets and resulted in unprecedented central bank interventions in advanced economies (AEs) and emerging market and developing economies (EMDEs) alike. Financial market dysfunction threatened financial stability and undermined monetary transmission. This paper looks at EMDE central bank interventions during the pandemic in core markets, namely money, securities, and FX funding markets. We focus on interventions aimed at combating market dysfunction as opposed to those providing monetary accommodation (i.e., quantitative easing). We combine empirical analysis with case studies to derive conclusions about effectiveness and to draw lessons about the design of future programs.

The impacts from EMDE central bank interventions were most strongly seen in the first two months after the announcement of a program. These impacts diminished over time as other factors adversely impacted market liquidity, including the relatively slow return of foreign investors. As these investors are a cornerstone of many EMDE markets, their prolonged absence hindered improvement in market liquidity. EMDE central banks did not always transact in large amounts. While in some jurisdictions the interventions were significant (Chile, Indonesia), in others, they were not (Philippines, South Africa).

The scale of liquidity injections associated with interventions sometimes had adverse implications for interbank markets—although in general these markets held up well. Larger advanced economy markets with deep and liquid markets were more resilient to liquidity expansion (Europe, the U.K., and the U.S.) whereas in EMDEs, we find cases where interbank market activity dried up and interbank interest rates fell relative to central bank policy rates. The EMDEs with more developed markets tended to fare better during the crisis. In general, we find that EMDE central banks were successful in mitigating the negative repercussions on market functioning caused by significant liquidity expansion.

As in developed markets, interventions were successful in stabilizing EMDE securities markets. This success is especially evident when measured in terms of the impact on prices, which significantly improved from the depressed levels reached in March 2020. We find evidence of improved liquidity across a range of market functioning indicators, including volumes traded and the width of bid-offer spreads. Much of the impact from central bank actions came from “announcement effects.” There were positive spillovers from the actions of major central banks which calmed major markets and provided strong tailwinds that assisted the effectiveness of EMDE central banks’ own interventions. In some cases, EMDE central banks saw market conditions improve without intervening themselves.

Central bank interventions played a pivotal role in mitigating the effects of the pandemic on EMDEs’ FX funding markets. Initially, widening bid-offer spreads and covered interest parity (CIP) deviations were observed. However, post-intervention, spreads contracted, signifying improved market functioning, and CIP deviations reversed, indicating easing U.S. dollar funding pressures. The Federal Reserve’s swap line announcements played a major role in normalizing market functioning, by contributing to the reduction of bid-offer spreads and promptly reversing CIP deviations. While EMDE central bank interventions moderately improved FX funding market liquidity by reducing CIP deviations, they did not significantly impact bid-offer spreads. Overall, these interventions, even in smaller scales, proved effective due to announcement effects.

Exiting intervention programs proved more challenging for EMDE central banks than their counterparts in advanced economies. In advanced markets, underlying liquidity improved sufficiently quickly that support

became less relevant and could be withdrawn relatively easily. Conversely, in EMDEs, where programs sometimes targeted multiple objectives, adverse impacts lingered due to expanded government financing needs and the absence of a resumption in capital inflows. Some EMDE central banks therefore needed to retain or even expand asset purchase programs (India, Indonesia), if only as a backstop against a shortfall in demand (Philippines, South Africa). EMDEs found it easier to withdraw programs that were more standard and better understood by markets, for example, short-term repo operations and FX swaps.

The COVID-19 shock highlighted the financial stability risks arising from vulnerabilities in non-bank financial institutions (NBFIs). It underscored the need to address liquidity pressures in the sector, sometimes by dealing directly with entities that are not central bank counterparts during normal times (Chile, India). EMDE central banks had to adjust their intervention approach to assist NBFIs, as they faced many of the same pressures seen in advanced economies, with increased precautionary cash demands contributing to investor runs, and compounded by a loss of liquidity in securities markets.

Our empirical analysis and case study reviews lead us to conclude that interventions by EMDE central banks were in line with their financial stability mandates, effectively addressing dysfunctions in core markets during the COVID-19 pandemic. We draw several policy conclusions for future EMDE central bank interventions:

- Intervention objectives should be well specified, particularly as regards addressing market dysfunction. For interventions with additional aims, such as monetary accommodation or government financing, clear communication should articulate how the program intends to address each objective. Exit strategies should be communicated ex-ante and tied to the achievement of the stated objectives.
- Objectives should also be realistic, acknowledging that the impact of intervention may be small or short lived and that other fundamental factors also drive market activity.
- Intervention triggers should be focused on metrics of liquidity and not prices. In challenging and fast-moving market conditions, operational flexibility, encompassing both qualitative and quantitative assessments, is essential for considering intervention triggers.
- Interventions should be large enough to address the identified market dysfunction while taking into account the potentially significant risks of fiscal dominance, moral hazard, and financial risks to central bank balance sheets.
- Where possible, program design should facilitate self-liquidation, such as through pricing (i.e., setting appropriate spreads) or involving short-term operations that roll off the balance sheet relatively quickly. Since interventions target core markets, the securities purchased should ultimately be sufficiently liquid to ensure they can be readily sold when market conditions stabilize.
- EMDE central banks should be well-prepared so that programs can be launched quickly in the event of a shock. The financial markets relevant to financial stability and monetary transmission (core markets) should be identified in advance with methodologies for determining dysfunction and modalities for intervention established. This may entail preparations for the expansion of collateral and counterparty frameworks.
- In some EMDE cases, interventions have significantly increased risks to central bank balance sheets, raising issues of policy solvency and operational independence. Normalization should entail reducing the balance sheet to a size no larger than required to efficiently implement monetary policy. Changes to the composition of balance sheets should reduce long-duration and higher credit risk assets accumulated during crisis periods.

I. Introduction

Central banks took significant steps to respond to the financial impacts of the COVID-19 pandemic in March 2020. During previous stress periods, it was primarily advanced economy (AE) central banks that introduced liquidity support programs, including asset purchases and FX swap lines. However, the COVID-19 pandemic saw emerging market and developing economy (EMDE) central banks join their AE counterparts in intervening to combat market dysfunction (Figure 1).

This paper examines EMDE central bank interventions during the COVID-19 period. It aims to extract lessons that might better inform central bank responses to future liquidity crises. Our focus is mainly on those programs aimed at preserving market functioning. These are programs that provided funding liquidity in local and foreign currency, as well as helped improve market liquidity through asset purchases, as distinct from quantitative easing programs, which provided monetary accommodation. This paper addresses the following questions:

- Were EMDE central banks effective in combating illiquidity in markets caused by the shock?
- To what extent did the impacts of interventions of major economy central banks spill over into improvements in liquidity in EMDE markets?
- Were EMDE central bank intervention programs well designed, and to what extent did program design conform to that expected from an ideally designed program?
- How easy was it for EMDE central banks to exit from crisis programs relative to the experience of AE central banks?
- How should central banks prepare for future periods of market dysfunction?

This paper examines empirically the impact of EMDE central bank actions on the liquidity of the most important markets—for pricing and managing risks—using a comprehensive set of liquidity indicators. We complement the empirical analysis with case studies to assess the degree to which specific intervention programs conformed to the ideal features of a well-designed program. These case studies also permit an examination of how alternative program design choices impacted the effectiveness and management of risks associated with intervention programs.

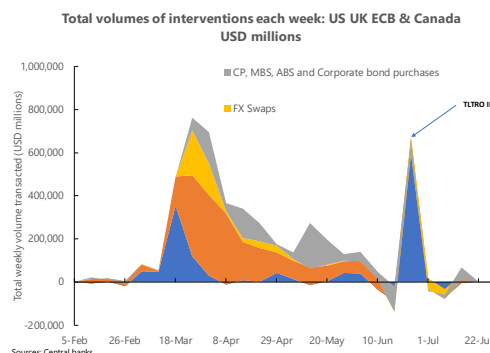
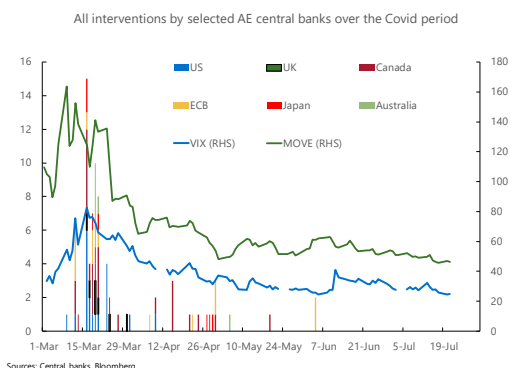
This paper builds on the existing literature on intervention effectiveness, particularly by central banks in advanced economies, which has generally demonstrated success in improving the liquidity of money, securities, and FX funding markets in the wake of the COVID-19 shock. We extend these studies of effectiveness to EMDE central banks mainly with reference to the impact on price-based as opposed to volumes-based liquidity indicators. The question of the appropriate design of central bank interventions programs in securities markets has been covered in previous IMF work and so this paper extends the analysis to the most important EMDE markets.¹

¹ See King et al. (2017).

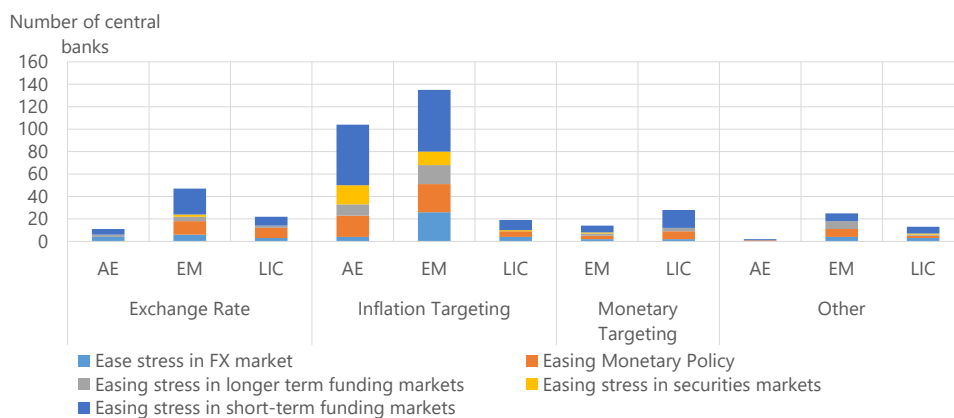
Figure 1. Range of Interventions Introduced in the First Half of 2020

Advanced economy central banks moved quickly...

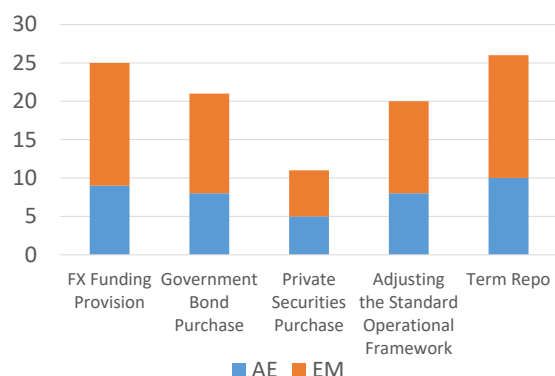
to substantially scale-up asset purchases and FX liquidity provisions.



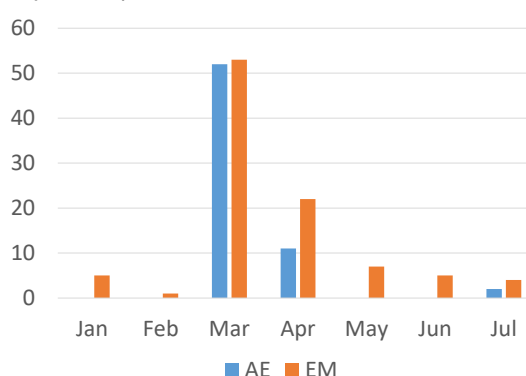
Central banks across various jurisdictions and monetary policy regimes acted to bolster market liquidity.



Central banks targeted a range of markets.



EMDE central banks were fast followers of their advanced economy counterparts.



Source: IMF staff calculations.

Note: ABS = asset-backed security; AE = advanced economy; CP = commercial paper; ECB = European Central Bank; EM = emerging market; LIC = low-income country; MBS = mortgage-backed security; MOVE = Merrill Lynch Option Volatility Estimate, an index of U.S. Treasury bond futures volatility.

II. Features of Well-designed Interventions

Market interventions are not standalone measures, but likely are part of a well-coordinated crisis management strategy requiring actions from multiple regulators, resolution agencies, and government. A framework for central bank interventions directed at securities market dysfunction (King 2017) can be applied to evaluate intervention programs implemented in response to the COVID-19 shock. This framework emphasizes the following key elements:

- *Intervention programs should have clearly specified objectives that align with the central bank's financial stability mandate.* The maintenance of financial stability encompasses supporting the transmission of monetary policy, maintaining the flow of credit, and mitigating the risk of market freezes that could result from fire-sale dynamics.
- *Interventions should target markets most critical for maintaining financial stability.* The focus should be on the largest and most interconnected markets, and which are most central to the transmission of monetary policy, the flow of credit, and as benchmarks for pricing and managing market risk. Such markets are typically liquid in normal times, and of high credit quality. In EMDEs, where markets are often less developed, this often means focusing on money, government securities, and FX funding markets.
- *The triggers for intervention should be well-specified and closely tied to financial stability objectives.* The timing of interventions is crucial, requiring judgement that balances the risks of acting too soon, with consequent moral hazard implications, against acting too late, with stress spreading and increasing the risk of insolvency. The triggers for interventions should have a high bar and be closely related to market functioning as opposed to limiting price movements.
- *Programs should be designed to address the identified problem, incentivizing the resumption of market activity while minimizing the risks to the central bank.* The first step is a diagnosis of the problem, with tools designed to address the diagnosed issue. Pricing and access should incentivize a resumption of market activity and, where possible, facilitate exiting the program through self-liquidating features such as appropriately set spreads or short-duration instruments. Financial risks must be considered, perhaps requiring government indemnity, while reputational risks can be managed with appropriate accountability and transparency mechanisms.

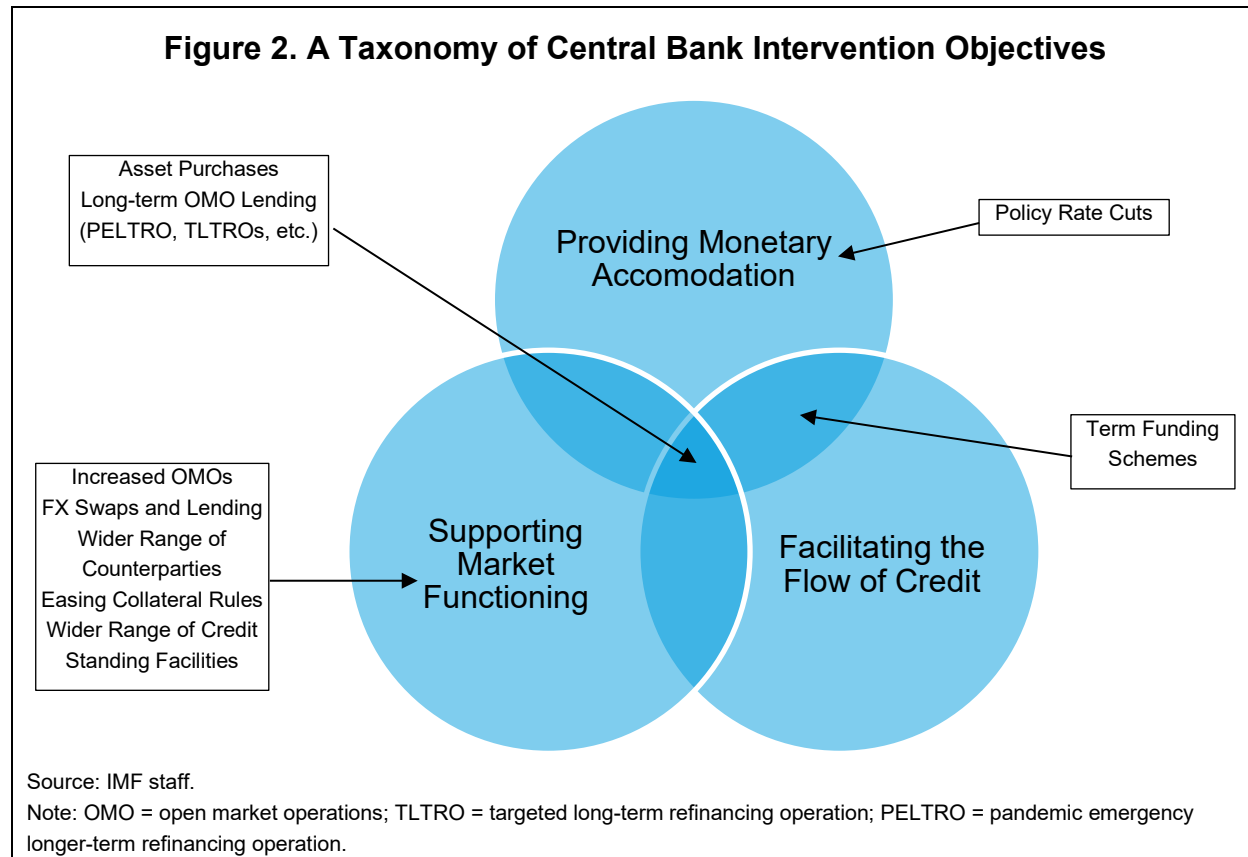
III. Motivations for Central Bank Interventions

Liquidity Stresses Prompted a Broad-based Response

Both AE and EMDE central banks intervened to support markets in the first half of 2020 in response to sharply deteriorating economic and financial market conditions. AE central banks moved quickly by cutting policy rates, providing abundant short-term liquidity, reintroducing, or scaling up asset purchases, and in some cases reintroducing Global Financial Crisis-era programs. EMDE central banks, while also cutting policy rates, focused on supporting short-term funding markets through measures such as term repos, lowering reserve requirements, adjusting the width of the interest rate corridor, and broadening collateral eligibility. The aim was to lower the cost of central bank liquidity while increasing access. FX funding support (via FX swaps, repos, and derivatives interventions) was also prevalent in EMDEs, reflecting the importance of FX funding due to higher dollarization and less developed domestic markets. Purchases of government securities in both primary and secondary markets were key components of the EMDE response. Government bonds tended to be the focus, as these markets are more developed in EMDEs than corporate securities markets. Often, the moves into the government bond market were novel (e.g., South Africa and the Philippines) reflecting the exceptional circumstances where even cornerstone investors in government bonds needed to raise liquidity or exit markets (for example, foreign investors, large banks, and pension funds).

Market Functioning Overlapped with Other Considerations

Three sometimes overlapping objectives drove central bank interventions (Figure 2). Firstly, central banks provided monetary accommodation to help cushion economies from the large negative shocks to growth and inflation. Here, cuts to policy rates, asset purchases, and long-term lending eased financial conditions. Secondly, central banks supported market functioning by broadening liquidity provision frameworks, introducing new facilities, and asset purchases. Thirdly, central banks helped maintain the flow of credit to the economy, including to the government, through purchases of government securities and targeted term funding programs (e.g., funding for lending schemes). The multiple objectives reflected the unprecedented shock, which significantly weakened the economic outlook while simultaneously escalating the liquidity needs of the government, banks, NBFIs, corporates, and the public. Hence, many intervention programs were targeted at more than one objective.



Intervention objectives tended to shift over time. Early in the pandemic, market functioning was prioritized when market stresses were most acute. Later, priorities often shifted towards providing monetary accommodation or, in a few cases, supporting the funding needs of the government. The rationale for the shift in objectives varied, encompassing both pressure from the government as well as concerns in EMDEs about the slow return of foreign investors. Hence, interventions used to calm markets early on (e.g., asset purchases and long-term OMO lending) were refocused on these other policy goals. Sometimes modalities changed with shifting objectives. For example, the Bank of England conducted asset purchases more frequently, in larger size, and targeted areas of the yield curve exhibiting the most signs of dysfunction.²

Interventions Were Consistent with Financial Stability Mandates

An extensive literature documents the drivers of market stress in AEs and EMDEs and reveals that central banks generally act in a manner consistent with their mandates. Examples include the Financial Stability Board's "Holistic Review" of the market turmoil in March 2020 (FSB 2020), the IMF's Global Financial Stability Reports of April 2020 and June 2020 (IMF 2020a, 2020b), a report by the G30 Working Group on Treasury Market Liquidity (2021), Liang (2020), Liang and Parkinson (2020), and IOSCO (2022). From the literature, five key themes emerge:

² See IMF (2022a, 46-48) and Figure 16 on how the Bank of England front-loaded purchases to address gilt market illiquidity.

- *Financial market volatility was amplified by leveraged investors* who uniformly attempted to liquidate assets to reduce risk and obtain cash.³ Increased volatility in Treasury markets was transmitted globally, creating liquidity pressures across a range of developed and EMDE markets.
- *The broad nature of shocks significantly impacted mutual fund liquidity, thereby undermining overall market liquidity.* Some classes of NBF1 (for example, money market mutual funds) were hit by investor withdrawals at the same time as market liquidity deteriorated. Markets that normally relied on mutual fund investors for liquidity (for example, money market mutual funds) suddenly lost their cornerstone investors and became illiquid.
- *Intermediaries' capacity to meet the increased customer demands was constrained.* Intermediary balance sheets came under pressure, coinciding with increased customer liquidity needs. This was despite intermediaries having significant liquidity reserves and access to central bank liquidity backstops. Finite balance sheet capacity and increased market volatility reduced intermediaries' risk appetite (IMF 2022a), undermining market liquidity.⁴
- *Some derivatives market users were unprepared for the combination of increased financial market volatility and reduced market liquidity.* Margin requirements increased when market liquidity was already under pressure, even in instruments perceived as highly liquid (money market mutual funds and government securities). Hence, the useable liquidity buffer from holding high-quality liquid assets as embodied in many investors' risk management frameworks quickly evaporated.
- *Official sector investors' liquidity needs increased, adding to pressure on markets.* Reserve managers often act as stable cornerstone investors that can provide liquidity when stress emerges. However, during the pandemic, official sector investors also needed to raise liquidity for FX intervention or to provide FX funding. This, in turn, undermined liquidity in AE government securities and money markets, prompting central bank action to bolster market liquidity.⁵

Several institutional and structural factors increased the challenges faced by EMDE central banks in responding to the shock. These included:

- Financial markets that are less well-developed and are hence less able to cope with increased volatility and reduced investor risk tolerance.
- Investor bases that are generally more concentrated around fewer core intermediaries, which can result in less resilience to large shocks.
- There is often a greater reliance on foreign investors, which can magnify the importance of global factors during global shocks.⁶

³ The impact of leveraged investors in the U.S. government bond market through “futures basis trade” is well documented (Barth and Kahn 2021). When COVID-19 hit, these investors were forced to exit which, exacerbating selling pressure from other sources.

⁴ See IMF (2022a).

⁵ The U.S. Federal Reserve introduced the Foreign and International Monetary Authorities (FIMA) Repo facility in March 2020 to mitigate the impact of heightened demand for liquidity from official sector investors on the U.S. Treasuries markets (Federal Reserve 2020a).

⁶ See Arslanalp et al. (2020) for a discussion and data on the significance of global capital flows for EMDE markets.

- Less developed and robust macroeconomic and institutional policy frameworks, making investor confidence less resilient to large shocks.
- The exchange rate often plays a greater role in anchoring inflation expectations, so a shock that reverses capital flows and depreciates the exchange rate can more easily de-anchor inflation expectations and undermine confidence.
- Generally, higher country risk premiums are observed, given limited macroeconomic diversification, constrained access to foreign resources, and less resilient banking sectors. Combined with a large global shock, these factors may undermine market confidence, resulting in a greater need for official sector market support.

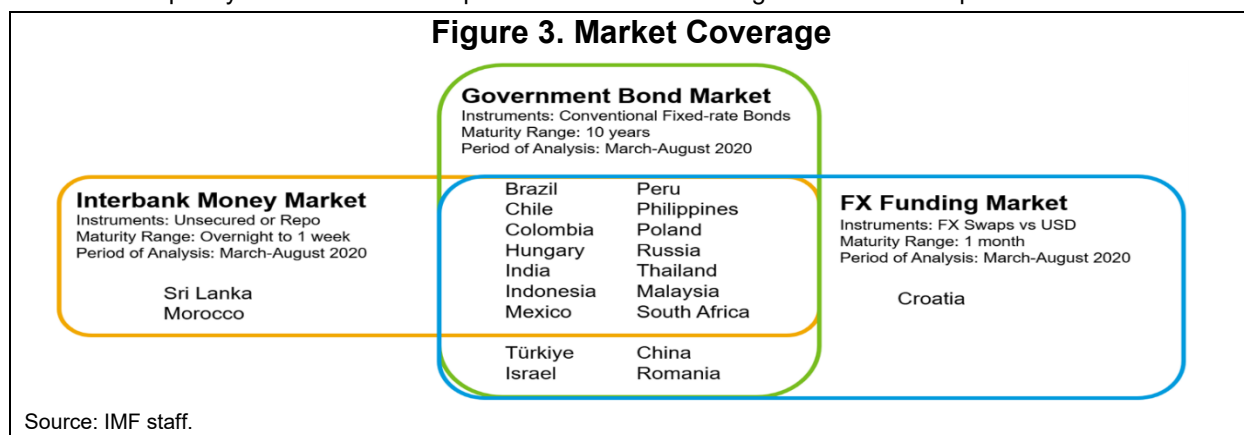
The motivation for central banks to support financial market functioning stems from their mandates for price stability (monetary policy) and financial stability (macroprudential policy). Even where a central bank's mandate does not explicitly encompass macroprudential objectives, it may still need to intervene to safeguard monetary transmission. The adverse impacts on market functioning, evidenced by significant declines in market liquidity, suggest that central banks' actions were consistent with their mandates. Therefore, the COVID-19 intervention experiences align well with the features of a well-designed intervention program, particularly in terms of financial stability objectives.

IV. Empirical Tests of Effectiveness

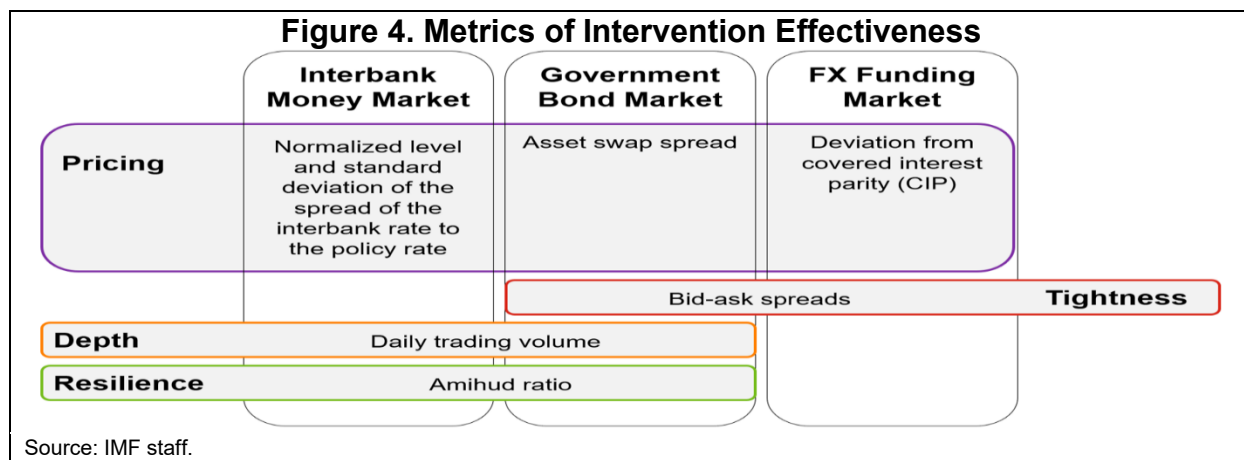
Coverage and Approach

We examine the impact of central bank interventions in core markets covering 74 countries, which represent 90 percent of global GDP (Figure 3). These interventions, announced during the peak of the financial stress between March to August 2020, encompass the period when most interventions occurred. The empirical analysis seeks to answer three questions:

- Were EMDE central bank interventions at the onset of the COVID-19 shock effective in improving the functioning of core liquidity markets (interbank money, government bond, and FX swaps)?
- What was the relative impact of the interventions of EMDE central banks compared to the actions of large, developed economy central banks for the functioning of EMDE core liquidity markets?
- How quickly did interventions impact markets and how long-lived was this impact?



To evaluate the effectiveness of central bank interventions, we first identify the relevant measures of market liquidity and functioning. While much of the existing literature focuses on market pricing and, at times, market tightness (such as bid-offer spreads), our approach is broader. In addition to price-based liquidity metrics, we also analyze volume and volatility-based metrics (Figure 4).



Daily data are used in the money and government bond market analyses except for the analysis of money market spreads. Here, the spread of the interbank rate relative to the policy rate is normalized by the average spread prevailing in the year prior to the shock. This normalization captures any pre-intervention systemic deviations of the interbank rate from the policy rate. In all the analyses, the daily data are converted to weekly moving averages to help smooth the day-to-day volatility observed, especially in transactions volumes. This smoothing helps account for idiosyncratic trading patterns, holiday and day of the week effects, and other factors that exist even in normal market conditions.

A more tailored approach is used in FX funding market analysis, as these markets all involve a common foreign currency, the U.S. dollar, on one side of the transactions. Here, we decompose the data on each liquidity indicator into a global common factor, and an idiosyncratic factor, using principal components analysis. We then model the impact of central bank interventions on each factor separately. This helps to differentiate between the impact of the interventions on global FX market liquidity (for example, when the Federal Reserve intervenes to liquefy U.S. dollar markets generally) as opposed to market specific effects (for example, when an individual central bank liquefies its own FX funding market). As data are not generally available on FX swaps volumes, the analysis focuses on bid-offer spreads and the deviation from CIP.

We employ a pooled cross-sectional and time-series panel data analysis to estimate the impact of central bank intervention announcements on market liquidity indicators. This approach allows us to leverage data on the full range of countries and interventions that occurred at different points in time. We use the local projections method (Jordà 2005) to estimate the linkage between intervention announcements and liquidity indicators. We also account for the impact of announcements related to the modifications made to the Federal Reserve's global FX swap lines, country specific fixed effects, and indicators of global risk tolerance in bond (the U.S. Merrill Lynch Option Volatility Estimate index) and equity markets (the U.S. Chicago Board Option Exchange Volatility Index, or VIX).⁷

⁷ See Jordà (2005, 161-182) for an exposition of the local projections technique.

Local projections (Annexes 7–9) allow us to identify both the impact of Federal Reserve interventions on global and local market liquidity and the marginal impact of central bank interventions in their own markets. In each market—money, government securities, and FX funding—we estimate a local projections model for each measure of market liquidity (Figure 4).

Money Markets

Money markets exhibited temporary and limited turbulence in the wake of the COVID-19 shock. Interbank market rates' volatility increased, and trading volumes declined.

We estimated impulse response functions covering three facets of interbank money market liquidity: (i) pricing (the normalized spread of the interbank rate relative to the policy rate and the standard deviation of this spread); (ii) market depth (daily traded volumes); and (iii) resiliency (using the Amihud ratio of standard deviation of the spread of the interbank rate to the policy rate divided by daily traded volumes). Four models (Annex 7) estimate the impact on each liquidity indicator of announced central bank interventions—either through term repos or by reducing reserve requirements—on each liquidity indicator. Without information on market expectations of interventions, we could not measure the “surprise” element of the intervention announcements. Therefore, the estimated impacts could understate the actual total intervention impact to the extent that some improvements in market functioning occurred in anticipation of the announcements.

Our analysis suggests that liquidity-providing interventions, including term repo and reserve requirements, had negligible effects on liquidity indicators, with most impulse responses not significantly differing from zero (Figure 5). The most pronounced effects, if any, appeared within 10–20 days post-announcement, suggesting a possible delay between the announcement and actual market interventions.

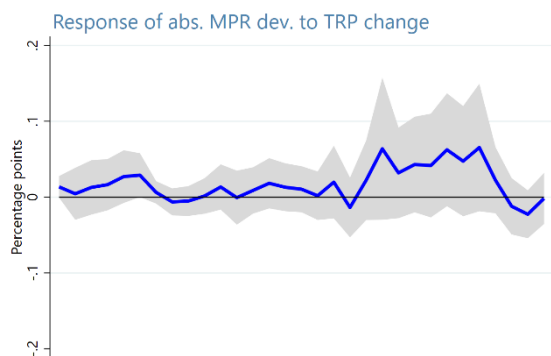
Evidence indicates that FX funding support announcements contributed positively to money market resilience, significantly diminishing interest rate volatility in relation to trading volumes. However, no spillover effects from interventions in other economies to EMDE money markets were detected.

Interbank rates generally remained anchored to policy rates, though not uniformly across all jurisdictions. Case studies from Indonesia and the Philippines showed deviations where increased structural liquidity led to interbank rates falling relative to policy rates, occasionally accompanied by reduced trading volumes. Similar trends were noted in some advanced economies, such as New Zealand.

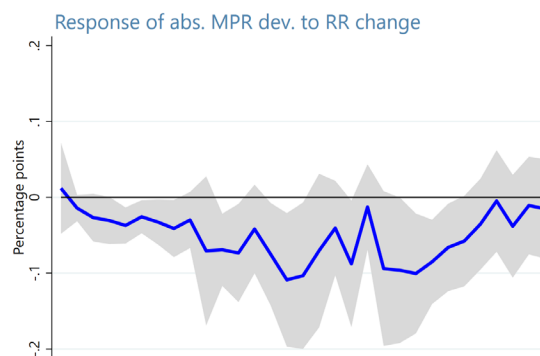
Overall, central bank operational frameworks proved resilient during the COVID-19 pandemic, handling the surge in liquidity without degrading market conditions. This resilience suggests that interventions were well-tailored to meet the increased demand for liquidity during the crisis.

Figure 5. Money Market Intervention: Estimated Impulse Responses

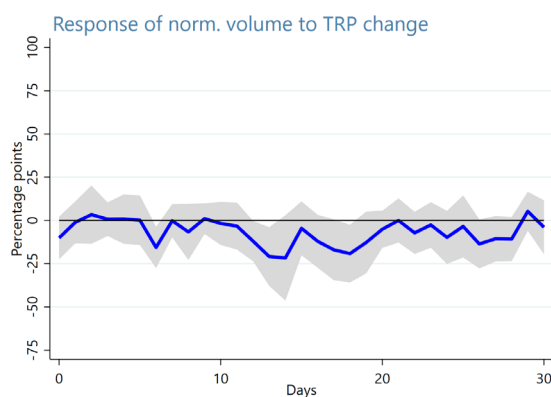
Interbank rates remained anchored to policy rates on average when repo interventions were announced.



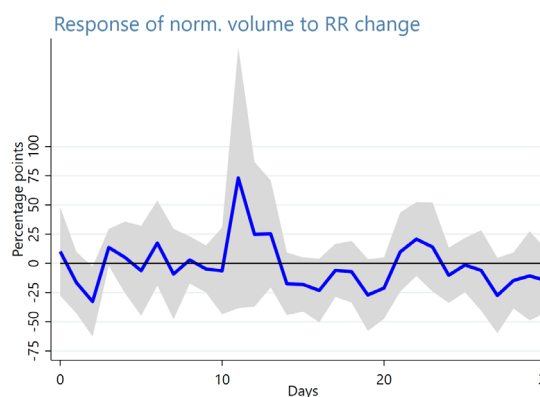
Reserve requirement cuts reduced interbank rates.



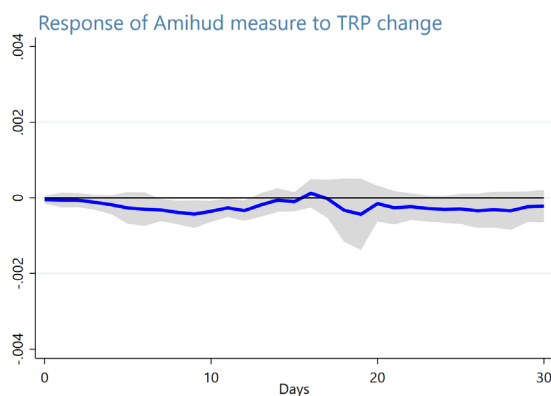
Transaction volumes fell insignificantly...



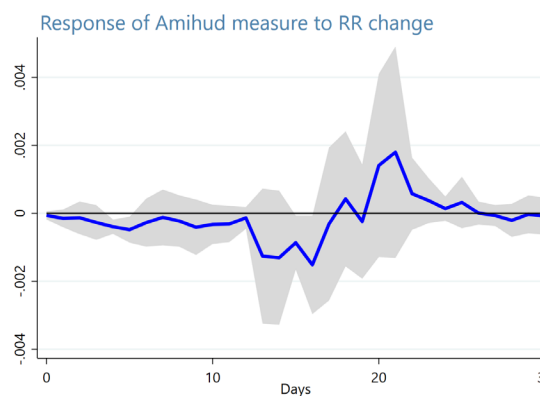
... and were unaffected by lower reserve requirements.



Overall, money market resilience held steady...



..., and seemingly unaffected.



Source: IMF staff analysis.

Note: MPR = monetary policy rate; TRP = term repo; RR = reserve requirements. Amihud measure (Amihud 2002) estimates the ratio of the volatility of prices compared to daily transaction volumes.

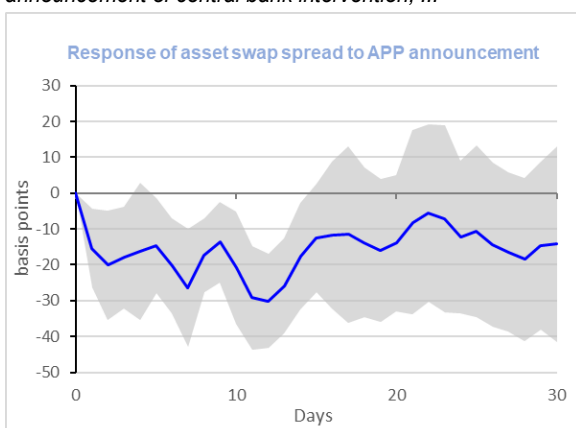
Government Securities Market

EMDE bond markets' liquidity deteriorated in the wake of the COVID-19 crisis, evidenced by both price and volume-based indicators. Bid-ask spreads and asset swap spreads widened, while trading volumes declined. The markets' resiliency, as gauged by the Amihud ratio, suggested that these markets became sensitive to swings in trade volumes.

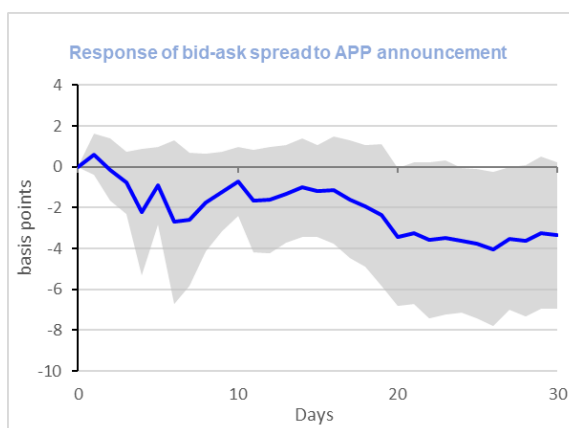
We assess the extent to which EMDE central bank intervention announcements impacted bond market liquidity (Annex 8) by examining the coefficients on the intervention announcement variable "APP" (asset purchase program) and the associated impulse response functions (Figure 6). For announcements to effectively improve market liquidity, the APP coefficient and associated impulse responses in the bid-offer spread and asset swap spread equations should be negative and significantly different from zero (i.e., bid-offer spreads and asset swap spreads should fall after an intervention announcement).

Figure 6. Government Securities Interventions: Estimated Impulse Responses

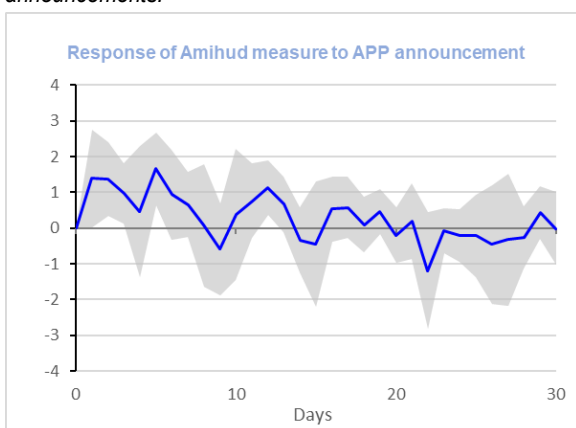
Government bond spreads to swaps declined after the announcement of central bank intervention, ...



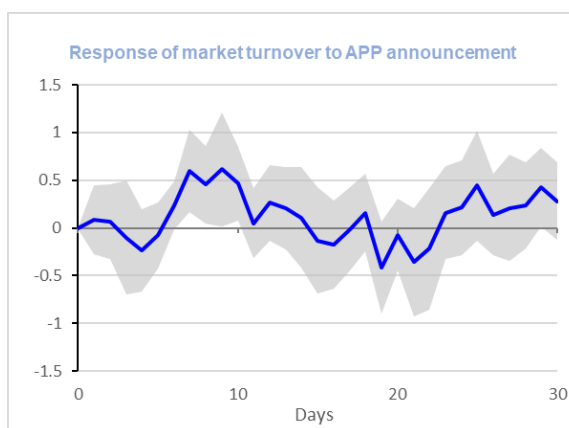
... as did bid-offer spreads.



The Amihud ratio remained broadly unchanged after announcements.



So, too, did market turnover.



Source: IMF staff analysis.

Note: APP = asset purchase program. Amihud measure (Amihud 2002) estimates the ratio of the volatility of prices compared to daily transaction volumes.

EMDE central banks' liquidity interventions in government bond markets were found to be effective. Central bank announcements correlated with improved price-based liquidity measures, including narrower asset swap spreads and notably tighter bid-offer spreads. The observed increase in market resiliency, as gauged by the Amihud ratio, suggests that post-intervention, these markets became less sensitive to swings in trade volumes. This finding corroborates literature assessing the influence of EMDE central bank interventions on bond market yields and spreads.

The impact of these interventions closely mirrors those observed in advanced economies, particularly showing a more pronounced effect on price-based liquidity measures. The swift normalization of yields, credit spreads, and basis margins in most advanced markets within months of the initial COVID-19 shock underscores the significant and rapid effectiveness of central bank interventions. This is particularly evident in the reduction of bid-offer spreads, which had dramatically widened at the outset of the crisis.

We found no evidence to suggest that interventions in EMDEs caused adverse spillovers in bond market liquidity within these markets. Instead, the analysis indicates that global factors heavily influenced EMDE market liquidity. Price-based liquidity measures, such as bid-offer spreads and asset swap spreads, displayed a high correlation across markets, deteriorating and subsequently recovering in tandem with shifts in global market volatility.

Our examination suggests that central bank interventions in EMDEs had a relatively prompt effect on market liquidity indicators, becoming evident within short periods, usually 1–2 weeks after announcements. This rapid response aligns with substantial evidence from advanced economies, underscoring the general efficacy of central bank interventions.

Nonetheless, although central bank interventions did not negatively affect market liquidity, their influence on bond market trading volumes remains ambiguous. While there is some evidence of a temporary boost in volumes shortly after announcements, over the longer term, market activity seems more driven by a diverse array of factors beyond central bank actions.

In conclusion, the intervention announcements by EMDE central banks were instrumental in enhancing liquidity and improving market resilience during periods of stress. Global market volatility, especially in the bond markets, had a significant but understandable impact on EMDE liquidity conditions. The rapid recovery in liquidity conditions post-intervention suggests that these central bank measures were an effective tool in stabilizing markets during the pandemic-induced turmoil.

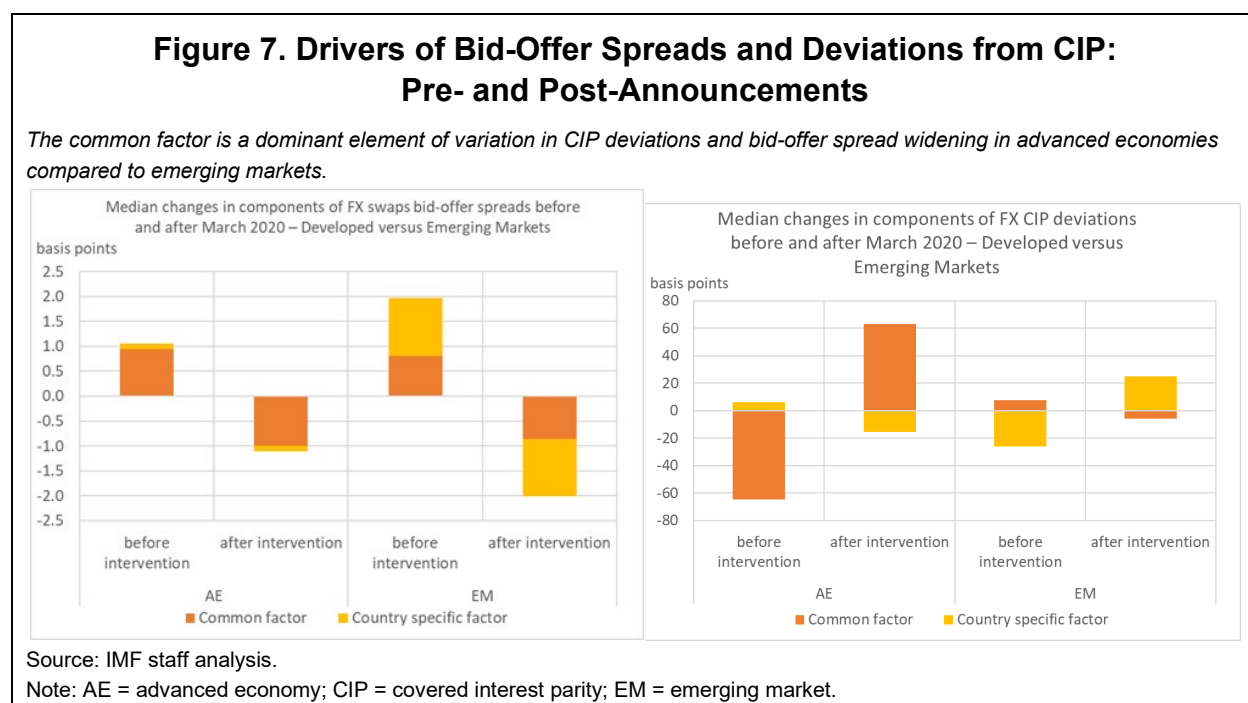
FX Funding Markets

The onset of COVID-19 saw an increasing scarcity of U.S. dollars in EMDEs' FX funding markets, as evidenced by growing deviations in many currencies' forward exchange rates from CIP. Additionally, the bid-offer spreads of FX swaps widened during this period. To better understand the drivers behind the two liquidity indicators, we performed a simple variance decomposition for each currency pair. Each indicator was broken down into a common global factor and a unique idiosyncratic factor. The global factor serves as the proxy for the general U.S. dollar supply, while the idiosyncratic components can be interpreted as country-specific U.S. dollar demand and risk premia components.

We assess the impact of central bank intervention announcements on EMDE FX funding market liquidity by examining the coefficients on the Federal Reserve intervention announcement dummy variable, along with

those from EMDE central banks' own announcements of U.S. dollar-providing operations (Annex 9). For the announcements to improve market liquidity, their respective coefficients should be positive and significantly different from zero. The impulse responses should indicate a decrease in bid-offer spreads after an intervention announcement and an increase in the CIP (Figure 8), implying a tightening of the negative deviation.

Central bank interventions were pivotal in mitigating the adverse effects on FX funding markets caused by the pandemic, as they significantly narrowed bid-offer spreads and CIP deviations across EMDEs. The interventions reversed the widening of bid-offer spreads caused by deteriorating liquidity conditions in FX funding markets. This widening, while prevalent in all markets, manifested differently: in AEs, it was driven by a common factor affecting all markets, whereas in EMDEs, country-specific factors were more influential (Figure 7). Post-intervention, there was a notable contraction in these spreads, effectively reversing the initial widening and indicating an improvement in market functioning. Similarly, the CIP deviations reversed after interventions, signaling a reduction of U.S. dollar funding pressures.

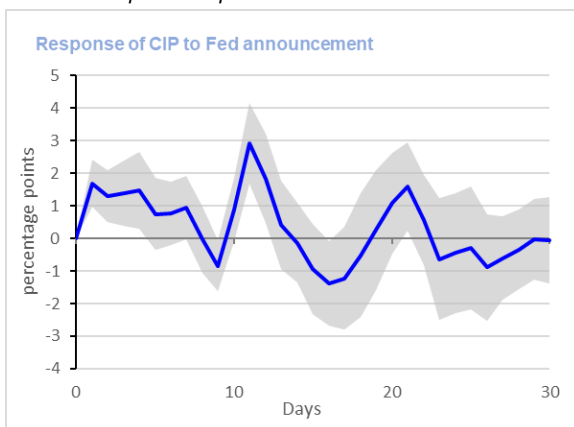


The Federal Reserve's swap line announcements were pivotal in normalizing market functioning, as reflected in the impulse responses of both market functioning indicators. Notably, the impulse response in Figure 8 (bottom left panel) shows that these announcements had the most significant effect on reducing bid-offer spreads. These announcements also contributed to the prompt reversal of the CIP deviations, effectively addressing U.S. shortages.

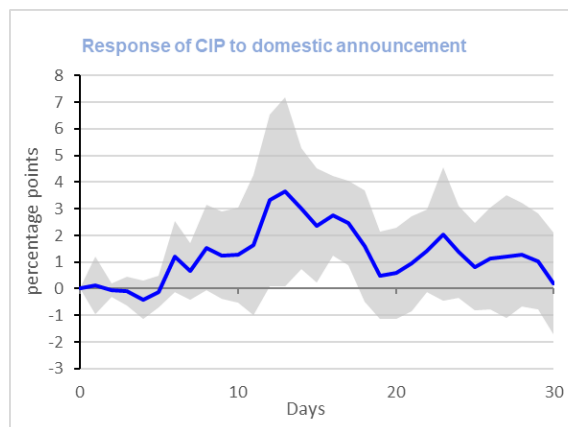
EMDE central bank interventions contributed moderately to the improvement of FX funding market liquidity by reducing the CIP deviations. Our findings indicate that these intervention announcements had a significant effect on these deviations, with the greatest impact occurring 10–15 days post-announcement (Figure 8, top right panel, and Annex 9, Table 1). As for the narrowing of the bid-offer spreads, EMDE central bank intervention announcements alone are not estimated to have played a role as the coefficients and impulse response function are not significantly different from zero (Annex 9, Table 1).

Figure 8. FX Funding Market Interventions: Estimated Impulse Responses

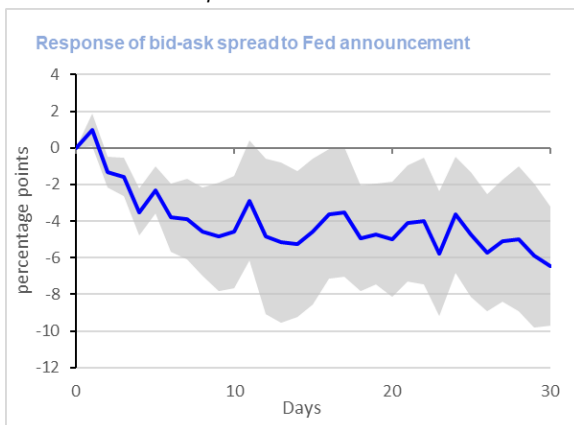
Announcements of the expansion/enhancement of Federal Reserve swap lines improved CIP deviations.



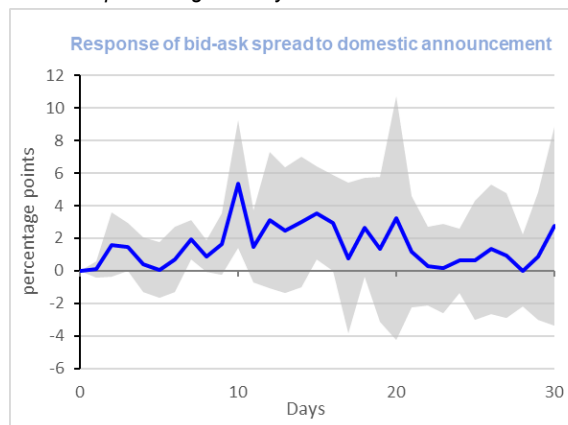
EMDEs own interventions played a role in improving CIP deviations.



Bid offer spreads narrowed mainly through the impact of Federal Reserve swap lines.



EMDE central banks own interventions did not impact bid-offer spreads significantly.



Source: IMF staff analysis.

Note: CIP = covered interest parity; EMDEs = emerging market and developing economies.

Global risk factors played a marginal role in driving bid-offer spreads in FX funding markets through the COVID-19 pandemic period. The coefficients on changes in the VIX index are generally statistically insignificant (Annex 9, Table 1). A small but significant impact is estimated to come through the common factor driving the changes in the bid-offer spread.

Many EMDEs managed to support market functioning without resorting to large-scale programs. Although comprehensive data on the volumes of transactions of EMDE central banks in FX funding interventions were not fully accessible, some information was available for a sizeable subset. These data confirm the notion that, in general, intervention programs did not have to be very large to achieve meaningful results. The maximum size of programs in EMDEs, based on the available data on total volumes, ranges from 0.1 to 3.8 percent of GDP, with a median program size of 2 percent of GDP. As noted above, much of the impact of intervention programs seems to come from announcement effects. Consequently, there was no need to commit significant resources to help improve market functioning.

V. Case Studies Findings

We consider the experiences of six EMDE central banks to distill lessons for the future design of intervention programs. The programs (Annexes 1–6) implemented in Chile, India, Indonesia, the Philippines, Poland, and South Africa were chosen as they reflect a wide range of approaches used. In each case, we assess the consistency of the program with the features of a well-designed intervention program discussed earlier.

Consistency with Financial Stability Objectives

Most objectives pursued by central banks were in line with their financial stability mandates. At the height of the COVID-19 market pressures, the intervention programs were able to meet all objectives without conflict, benefitting significantly from regulatory forbearance in many jurisdictions. Key elements of financial stability—such as preserving transmission, supporting market functioning, and facilitating the flow of credit—were central to these efforts. Supporting government financing needs was less centered on financial stability but was initially aligned with broader macroeconomic goals. In some cases, financial stability objectives, such as improved market functioning, were first met, while the governments' financing needs remained significant.

Intervention programs were usually aimed at meeting multiple objectives (Table 1). The South African Reserve Bank (SARB) was unique in focusing solely on market functioning, reflecting the macro impact of the shock, the reversal of capital flows that stressed interbank and government bond markets, and the potential effects on the country's sovereign credit rating, which was already under pressure from earlier political instability. All the other cases feature multiple objectives and correspond to positions near the center of the stylized intervention objectives (Table 1).

Supporting market functioning was a core objective across all programs. Central banks highlighted how the shock, increased risk aversion, and reversal of capital flows impaired the markets' ability to efficiently price and allocate liquidity and funding. Asset purchases, money market injections, and FX funding support all sought to provide a better balance in markets. These measures removed risk from the market and supported intermediaries' funding, thereby aiding price discovery and market-making services to customers.

Except for South Africa, providing monetary accommodation and enhance monetary transmission was a uniformly shared objective. This goal was pursued by injections of liquidity through asset purchases and OMOs, and by mitigating the widening of credit and term spreads caused by the shock.

	Poland	India	Indonesia	Philippines	Chile	South Africa
	Providing Monetary Accommodation					
Supporting Market Functioning	government bond market	interbank, corporate paper, and government bond markets	FX funding and government bond markets	interbank and government bond markets	FX funding and bank bond markets	interbank and government bond markets
Facilitating the Flow of Credit	to government	to government and NBFIs	to government	to government		

Source: Authors.
Note: NBFIs = non-bank financial institutions.

Supporting government financing was an important subsidiary goal of many of the programs. In all cases, it became increasingly difficult for governments to access market financing, especially with non-resident investors slow to return. Therefore, the need to backstop government financing or counteract what were perceived as excessive increases in financing costs became an important element of some programs. This was particularly evident in Indonesia, where both primary and secondary market interventions were made. In Poland, constitutional limits on direct government borrowing resulted in greater reliance on quasi-government financing in markets that were not normally liquid and certainly very illiquid during the COVID-19 period. In India, constraints on government financing coincided concerns about the ability of mutual funds to continue funding corporates. In response the Reserve Bank of India (RBI) launched a liquidity support program to backstop mutual funds financing capacity.

Were Interventions Focused on Markets Most Critical for Financial Stability?

A range of operations were undertaken to support the functioning of key markets (Table 2). All central banks intervened to support their interbank money markets through repo operations—either by scaling up short-term repo OMOs or lengthening the maturity of repo liquidity provisions. This focus reflects the core role that money markets play in liquidity and funding intermediation. Government bond purchases, usually in secondary markets, represented the second most prominent type of intervention. Indonesia was the exception, implementing purchase programs in both primary and secondary markets.

FX funding market support programs were also prominent (Chile, Indonesia, India), although in most cases these programs were not heavily used as the shock did not expose significant FX liquidity mismatches. This was either due to a tight regulatory framework that contained mismatches (India), or because markets did not go into the shock with FX liquidity shortfalls. In Chile, for example, the pandemic followed a period of domestic political instability that had already resulted in capital outflows, which the central bank responded to earlier with FX liquidity provision tools.

Interventions outside of government securities markets reflected the relative importance of specific markets, and here there are two interesting cases: Chile, which conducted secondary market purchases of bank bonds, and Poland, which purchased government agency bonds. In Chile's case, bank bonds are viewed as systemic, given their market size is twice that of the government bond market.⁸ Poland's case is less clear, as the agency bond market is not typically a liquid benchmark, whereas the government bond market is one of the most developed in Eastern Europe. In this case, a mix of intervention objectives appears to have played a role. Legal constraints on the government's ability to expand bond issuance resulted in an increase in agency bond issuance, placing strain on available liquidity in the agency bond market. The central bank stepped in to support the agency bond market and, in the process, helped support the government's elevated pandemic-related financing needs.

⁸ Also, the Chilean central bank law prohibited government bond purchases until legal amendments were made in August 2020.

Table 2. Case Studies: Operational Modalities

South Africa	Philippines	Indonesia	India	Poland	Chile
Scaled Up or Lengthened OMOs					
Cut Credit Facility Rate	Reduced Reserve Requirements			Collateral Expansion	
		FX Funding Provision			FX Funding Provision
Government Bond Purchases					
				Other Bond Purchases	
			NBF Liquidity Support		NBF Liquidity Support

Source: Authors.
Notes: NBF = non-bank financial institution; OMOs = open market operations.

Well-specified Triggers Tied to Financial Stability Objectives

In all cases, the severity of the shock resulted in a significant increase in price volatility in FX spot and funding markets, money markets, and bond markets at the onset of the crisis. This increase was rapid and, in most cases, volatility was very high compared to historical norms, which undermined price discovery. A reversal of non-resident capital flows was a key factor that undermined market depth and resiliency, affecting some countries (Chile, Indonesia, Poland, South Africa) more significantly than others. Sovereign bond markets, along with FX spot and funding markets, bore the brunt of the withdrawal of foreign investors.

Increased risk aversion among domestic investors led to reduced liquidity in core markets and raised the potential for fire-sale dynamics. In all observed cases, there was a notable reluctance to invest in riskier asset classes, especially government bonds (due to interest rate risk), commercial paper, and corporate and bank bonds. Increased risk aversion was a key factor driving precautionary liquidity demand and an increased supply of riskier assets, such as bonds and corporate paper, into markets where intermediaries were less willing to take risk. Evidence of fire-sale dynamics was observed in jurisdictions where NBFs faced elevated redemption pressures, notably in Chile's pension funds and Indian mutual funds. Central bank interventions were, in part, aimed at quelling such pressures—sometimes with novel interventions (India's mutual fund support program).

Money markets saw a sharp increase in the demand for liquidity, which served as a motivation for intervention. This increase was manifested by higher interbank interest rates relative to policy rates, increased use of central bank credit standing facilities, reduced demand for OMO sterilization operations, and increased demand for term repo funding. Increased volatility and premia in FX swaps markets also played a role. Some markets saw marked increases in short-term commercial paper rates and spreads (especially India), which indicated increased pressures in money markets.

Similarly, there was a sharp deterioration in market liquidity. In some jurisdictions, there were marked increases in bond market pricing spreads (India, Philippines, Poland, and South Africa), reflecting unbalanced markets and associated difficulties in price discovery. These observations closely align with the results of the empirical analysis, which found that bid-offer spreads responded especially well to EMDE central bank interventions. The

increase in price volatility and widening spreads led to reduced trading volumes in many of the EMDE markets examined. In certain instances, the central bank was seen to be one of the few buyers of government bonds during March/April 2020 (Philippines). Traded volumes declined despite the growing need for investors to sell securities (India). Central banks were concerned that the lack of market depth could further exacerbate price movements, potentially driving fire-sale dynamics.

The overall conclusion is that intervention triggers were appropriately aligned with financial stability considerations. Quantitatively, price-based indicators—market depth, credit and term spreads, and volatility clearly—clearly demonstrated the enormity of the shock. Qualitatively, information on the behavior of investor flows and increased precautionary demand for liquidity is also consistent with the significantly heightened risks to financial stability.

Transparency

Transparency around interventions is important for effectiveness, risk management, and accountability reasons. Interventions help support market functioning by signaling that there is a buyer in markets where there was previously a supply/demand imbalance. The clearer a central bank is about its interventions, the more impactful they can be. When price discovery is impaired, providing clarity around the prices at which the central bank has intervened in markets helps reduce the information asymmetry that otherwise exists. Transparency regarding intervention objectives reduces the risk of misinterpreting the central bank's actions and motivations and can help guide markets on what to expect when interventions are exited. Moreover, ex-post transparency on intervention results is useful for accountability, which, in turn, enhances central bank credibility.

Central banks demonstrated a high degree of ex-ante transparency on intervention objectives and modalities. In each case, they comprehensively explained the nature and objectives of their intervention programs. Often, communication was multilayered and tailored to different audiences. This included speeches and press releases by senior central bank officials directed at the press and public, as well as bilateral discussions with market participants about operational details. This strong emphasis on transparency at the outset aligns with central banks' efforts to maximize the impact of their interventions to calm markets, as well as to avoid misinterpretation of their actions.

Ex-post transparency was mixed. Some central banks did a comprehensive job in announcing both operational details and subsequent results (e.g., Chile and India). These central banks aimed to maximize the impact on price discovery, reduce information asymmetries, and prevent misunderstandings or misinterpretations of their actions. Other central banks took a less transparent approach, or gradually developed communications over time. South Africa's bond market interventions were done covertly as the results of bilateral transactions were not announced. This approach reflected a desire to reduce risks of markets gaming the central bank and to reduce moral hazard risks through over-reliance on the SARB's purchase program. Indonesia and the Philippines also did not publish results of asset purchase operations, though in the Philippines' case, information on the purchases could eventually be derived from market data services. The absence of published results in the Philippines raised questions about the status of the bond purchase window, causing banks to regularly contact the Bangko Sentral ng Filipinas (BSP) for quotes to verify its operational status. Communication in Poland evolved over time: initially, results were published irregularly, leading to some confusion among market participants, but later, results were published more regularly.

Central banks often set criteria to signal the end of crisis intervention measures. The most common approach was to announce the end or review dates for the interventions, as seen in Chile, Indonesia, and the Philippines. Occasionally, central banks would keep the markets informed about the progress towards meeting the objectives of the interventions. This approach helped guide market participants on when interventions might be scaled back, as exemplified by the BSP, which regularly discussed these matters in their regular Monetary Board meeting minutes. In some cases, central banks (e.g., India) set quantity and duration targets for asset purchases to guide markets on when they should expect operations to scale down.

Regarding communication about exit strategies, the criteria were not clearly defined. Both Poland and South Africa did not clearly discuss exit criteria at the outset of interventions, as their focus was more on communicating objectives and calming markets. Even in cases where review dates were communicated, mixed objectives sometimes meant that program end dates were extended after markets had normalized. For example, there was still an ongoing need for monetary accommodation or government financing support in Indonesia and the Philippines, as well as a need to extend Chile's bank bond purchase program.

Central banks that clearly communicated and implemented their exit plans often fared better. Exits were notably smoother in cases involving short-term open market operations and FX swaps to support money market liquidity. EMDE central banks were able to scale back these operations relatively quickly, partially due to their design (providing liquidity at a premium to normal market rates) but also because markets better understood the factors the central bank would consider when scaling back liquidity support. As these types of tools had a more established track record of use in EMDEs, it was easier for market participants to understand how they might be scaled back as liquidity conditions improved.

EMDE central banks often had a tougher time where intervention objectives were mixed, such as when the aim was to support market functioning while also providing credit to the government or the economy. In some cases, the morphing of objectives from market support to providing credit made it harder for central banks to exit—particularly in government securities markets—as the prolonged absence of foreign investors made the resiliency of markets less certain (India, Philippines, Poland). Exit proved even more challenging in cases where the central bank provided little ex-ante guidance on the exit strategies. For example, South Africa adopted a highly discretionary intervention approach, allowing operationally flexible and reducing the need for the SARB to commit significant resources to support the government securities market. However, exiting the government bond purchase program became challenging due to concerns that the announcement of the SARB's exit could trigger illiquidity. The SARB was drawn into reinvesting maturing proceeds, despite normalized market conditions, as markets were not sure about their approach and expected at least some level of reinvestment to occur.

Managing Central Bank Financial and Operational Risks

Central banks faced increased financial risks as their balance sheets expanded. For most, this expansion was significant, mainly reflecting increases in local currency-denominated assets in the form of OMO lending and longer-term securities holdings (Table 5). South Africa was an exception, where the balance sheet expanded only marginally, a reflection of the SARB's limited-scale government bond purchase program. Interest rate risks increased significantly given the large purchases of local currency assets (Table 5)—usually domestic sovereign bonds. These bonds were longer duration than the usual OMOs instruments, therefore materially increasing interest rate risks and resulting in losses when interest rates rise. Sterilization costs have the potential to be relatively large—and central bank balance sheet losses sizeable—given that policy interest rates

have moved well above historical norms. During the crisis period, sterilization was not of immediate concern as most central banks wanted to expand excess liquidity to aid monetary accommodation. Post-crisis, as the monetary policy cycle normalizes, sterilization costs will become more prominent. This will occur either through the issuance of sterilization instruments (for example, in the Philippines, where the BSP has introduced new BSP securities) or as the interest paid on excess reserve balances increases alongside the policy rate. The increase in local currency assets in many cases is large as a proportion of GDP (Table 4), and the associated costs will be a significant drag on the underlying earnings of the central bank. It will also reduce capacity to build capital through retained earnings, and to pay dividends to the government.

Central banks have significant additional exposure to the government, which could raise concerns about fiscal dominance and independence. As most accumulated assets are government securities, the central bank has become a dominant investor in these securities. Assuming these are held to maturity, the exposure to the government is long-term. In some cases, these risks have been partially managed. For example, Indonesia implemented a burden sharing agreement, and the BSPs advances to the government were ultimately repaid in full in 2022, leaving only its bond holdings on the balance sheet. However, the generally long-duration bond holdings and the ongoing nature of some asset purchase programs have the potential to complicate the relationship between the government and the central bank, affecting the independence of policy implementation. Concerns about the balance sheet impact of increased policy interest rates could, at the margin, deter central banks from raising interest rates as quickly or as much as might otherwise be warranted (Hooley et al. 2023).

**Table 3. Case Studies: Central Bank Balance Sheet Changes
(February–December 2020)**

	Change in Balance Sheet Size		Change in Net Local Currency Assets		Change in Domestic Bond Holdings	
	%	% GDP	%	% GDP	%	% GDP
Chile	88.6	13.9	1,242.7	14.7	2,152.5	14.7
India	25.5	5.9	35.7	1.9	31.7	1.6
Indonesia	24.6	4.0	75.7	3.7	102.8	3.4
Philippines	38.5	11.0	123.6	6.9	512.3	6.4
Poland*	35.1	8.0	119.5	5.5	N/A	3.3
South Africa	-4.7	-0.9	1.9	0.1	404.5	0.6
Average	34.6	7.0	266.5	5.5	N/A	5.0

Source: Authors' calculations.

Note: Poland reported no domestic bond holdings as of February 2020, hence % growth is not calculated.

In most of the cases, credit risks were generally low because the securities acquired were government securities, or the lending programs were well collateralized, short-term, or conducted through banks, as seen in the RBI's mutual fund liquidity support program. An exception was Chile, where the central bank took on some bank credit risk through the accumulation of bank bonds (Table 5). In such cases, central banks may need to provide for expected credit losses (under International Financial Reporting Standards) and as a result, increase their capital buffers.

Some central banks faced operational challenges to quickly implement programs. Certain types of interventions, especially bond purchases, were new for some central banks and they did not have well-established procedures infrastructure to conduct the operations. This was evident in Poland, where the results of bond purchase operations were released at irregular intervals, which complicated portfolio management of market participants. Additionally, the Philippines lacked the capacity to immediately conduct auctions to purchase government bonds, and instead utilized a bond purchase window, which is less desirable from price discovery and transparency perspectives.

In the aftermath of the crisis, central banks should reassess the necessary size of their capital buffers to address shocks and the associated risks to their balance sheets. In some cases, this might mean rebuilding buffers through delays in dividends or recapitalization, especially if capital is depleted and operating losses are anticipated over the medium-term. These losses may arise from higher net interest costs due to the need for higher policy rates and the holding of low-yielding long-term securities accumulated during the crisis. Preparation for implementing crisis market support would have helped in at least a couple of cases and is indicative of the need for central banks to adequately plan in normal times so that crisis operations can be quickly and efficiently implemented.

Interventions and Money Market Activity

A recurring concern was the challenges encountered in interbank money markets due to a large injection of reserves from crisis interventions. Most of the markets examined saw these problems to some extent (Chile, India, Indonesia, Philippines). Markets where a small group of banks tend to dominate interbank trading in normal times tended to see activity drop off significantly when banks received a significant influx of reserves as central bank balance sheets expanded. Issues ranged in severity, from modest (India) to much more significant (Chile, Indonesia, Philippines). Jurisdictions where interbank markets were better developed and that had a more diverse range of participants seemed to be more resilient (Poland, Philippines). In India, interbank money market activity declined; however, activity in commercial paper markets improved primarily due to RBI's support to mutual funds.

Transmission seemed to hold up despite reduced activity in money markets. We do not find evidence of widespread or persistent weaknesses in monetary transmission in the case study analysis, aligning with the results of the panel data analysis. However, in some instances, central banks had to adjust their operating frameworks to accommodate additional liquidity. For instance, in Indonesia, interest rates have moved and remained near the floor of the BI's interest rate corridor, leaving the BI in a situation where it now de facto operates a floor implementation system.

Exiting

Central banks should intervene as necessary to maintain market functioning, consistent with their financial stability mandate, and should then exit once functioning is restored. In practice, this does not necessarily mean that markets have returned to pre-crisis levels, but rather to the point where market participants can manage risks at reasonable costs and where a basic level of price discovery can occur.

Advanced country central banks navigated the exit from market support interventions relatively well. For example, the Bank of Canada swiftly scaled down and withdrew its market support programs.⁹ Similarly, the Bank of England reduced the size and frequency of its gilt purchase operations from mid-June 2020, reducing them to levels consistent with the provision of monetary accommodation from early August 2020.¹⁰ And the Federal Reserve supported the Treasuries market with large scale asset purchases and short-term repo operations during March and April 2020, scaling back these operations by summer 2020.¹¹ In July 2020, the Fed successfully scaled back U.S. dollar liquidity provided through central banks swap lines to support FX funding markets. Demand for these facilities peak relatively quickly (April/May 2020) and fell quickly as market functioning improved. The design of many of these facilities aided the exit process, as many of them were structured with pricing levels that were attractive when conditions were stressed, but not when conditions normalized. An example of this is the Federal Reserve's Term Asset-backed Securities Loan Facility.

Although the removal of programs in AE jurisdictions was well-telegraphed and in line with improvements in underlying market functioning, exceptions occurred. The Federal Reserve abruptly withdrew several of its programs that required U.S. Treasury approval at the end of December 2020, including the primary and secondary market corporate bond programs, the Municipal Liquidity Facility, and the Term Asset-Backed Securities Loan facility.¹² Other Federal Reserve liquidity facilities that needed U.S. Treasury capital support were extended a further 90 days, with most withdrawn by end-March 2021.¹³ While all of these programs were formally scheduled to expire at the end of December 2020, and the U.S. Treasury having the option to extend them, there was some market expectation for the continuation of certain facilities. Nonetheless, the expiry of these liquidity support facilities did not create problems, indicating that their use had declined with improvements in market functioning and the ample liquidity conditions created by the Federal Reserve's post COVID-19 monetary accommodation policies.

Prior experience in advanced country central banks—especially during the 2008 Global Financial Crisis—aided a smooth exit. Most of the emergency facilities used by the largest AE central banks in response to COVID-19 had been used earlier and were well understood by the central banks and market participants (for example, the programs used by the central banks of Canada, the U.K., and the U.S.). Similarly, the network of FX swaps lines was already established among the largest AE central banks, and even the expansion to a wider group of countries had precedent, as these countries had access to FX swap lines during the Global Financial Crisis. Because of their well-established nature and prior preparation, it was easier for central banks to scale up and scale back the support these programs provided, effectively communicating their motivation to markets without disrupting market expectations and functioning.

⁹ See, for example, the June 2020 announcement to reduce the frequency of the Bank of Canada's term repo and Bankers Acceptances purchase operations (Bank of Canada 2020a), and the August 2020 announcement to progressively tighten eligible collateral requirements in the Bank of Canada's Standing Liquidity Facility from August 2020 to their pre-COVID-19 levels by the end of September 2020 (Bank of Canada 2020b).

¹⁰ See the IMF (2022; Figure 16) for charts showing the profile of the Bank of England's gilt purchase operations during the COVID-19 period.

¹¹ Logan (2022) discusses the Federal Reserve's approach to providing support to the Treasuries market over the COVID-19 period.

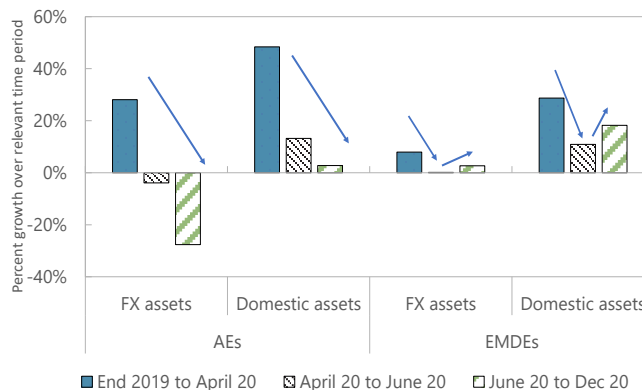
¹² See the November 19, 2020, letter from Treasury Secretary Steven Mnuchin requesting the Federal Reserve return the capital supporting these facilities (United States Treasury 2020).

¹³ See Federal Reserve (2020b) announcement of the final extension of the Commercial Paper Funding Facility, the Money Market Mutual Fund Liquidity Facility, the Primary Dealer Credit Facility, and the Paycheck Protection Program Liquidity Facility.

The experience of EMDE central banks has been more varied as they often took longer to withdraw their programs. Trends in the size of central bank balance sheets indicate the extent of the challenges. AE central bank balance sheet growth slowed relatively quickly from the second half of 2020 as market conditions improved and liquidity provision either stopped or reverted to the slower steadier growth associated with ongoing quantitative easing (QE) programs. For EMDEs, growth in domestic assets continued to be quite strong in the second half of 2020, in part reflecting ongoing crisis support operations (as well as QE).

Change in central bank domestic and FX assets pre/post initial Covid-19 shock

(Percent change over initial shock period and post shock periods)



Source: IMF staff calculations.

Note: AEs = advanced economies; EMDEs = emerging market and developing economies.

EMDE central banks often utilized tools for the first time or after a long lag from their previous use. Examples include the Philippines and South Africa, with secondary market purchases of government securities, Indonesia, with primary and secondary market government bond purchases, and India and Thailand, which provided liquidity support to mutual funds, among many others.¹⁴ Sometimes these programs were hastily arranged, with little focus on determining an exit strategy. Since markets had not seen EMDE central banks use these types of tools in recent times, there was uncertainty about the process and speed of their eventual phasing out.¹⁵

The multiple objectives of many EMDE intervention programs (see earlier discussion on overlapping objectives) complicated exit, with macro challenges persisting long after market functioning improved. For example, in the Philippines, several support measures (Annex 5) were aimed at improving market functioning and supporting the government's financing needs. These needs persisted long after market liquidity improved. Liquidity in bond markets remained brittle in the face of significant government financing requirements and, in part, because foreign investors who are often cornerstone participants (for example, Indonesia), were slow to return. Further, central banks were often still providing monetary accommodation after markets had largely healed.

Exit criteria were not usually well developed or communicated at the start of market support programs, complicating the communication of exit. Sometimes indicative sunset clauses were communicated (the Philippines initially indicated a six-month horizon) but more generally the focus was on launching the programs. In many instances, markets were left to speculate on the criteria central banks might use to withdraw programs. Occasionally, this led market participants to closely monitor indicators, such as the size of the central banks' bond portfolio, to discern if a program was being terminated. For example, in South Africa, there was interest in whether the SARB would reinvest maturing proceeds in early 2021, even though few purchases had been made by the SARB for some months.

¹⁴ See Annexes 1-6 for details on the programs implemented in India, Indonesia, the Philippines, and South Africa. The Bank of Thailand Mutual Fund liquidity support program (and other programs) are discussed in Box 3 of the Bank of Thailand's March 2020 Monetary Policy Review at <https://www.bot.or.th/en/our-roles/monetary-policy/mpc-publication/Monetary-Policy-Report.html>.

¹⁵ In the case of the BSP, market participants continually contacted or "tested" the central bank's facilities to assess the extent to which they were still operational or available (see earlier discussion and Annex 5).

Some types of support programs were more easily withdrawn or scaled back in EMDEs as they were a more standard part of the liquidity management toolkit. Two such areas were the short-term money market and FX swaps, where EMDE central banks managed to scale back liquidity provision through short-term open market operations or through resumed sterilization operations, as seen in the case of the Philippines (Annex 5). This largely stemmed from markets and central banks being more familiar with these tools (and perhaps also that AE central banks were well-advanced in terms of withdrawing this type of support early in the pandemic). The track record of use of these tools, along with better-established operational and communications protocols, reduced the risks of missteps and misinterpretation of exit and ultimately helped smooth the path to a more normal operational stance.

VI. Implications for Future Programs

There is clearly a case for EMDE central banks to intervene to support market functioning. The empirical analysis and review of the individual cases suggest that EMDE central banks can assist market functioning when large shocks hit domestic markets. However, it should be recognized that the positive effects of interventions are likely relatively small compared to other more fundamental factors driving market liquidity (for example, risk attitudes of global investors). Interventions also entail costs, both financial costs for the central bank and potentially moral hazard, since market participants may take more risk in the belief that central banks will provide insurance against tail risks.

EMDE central banks should focus interventions on core markets that are typically liquid in normal times. These markets are not only more likely to recover after the shock has passed but also play a crucial role in managing funding, liquidity, and market risks in EMDEs due to their interconnectedness and importance.¹⁶ Central banks should ensure their interventions are sufficient to support funding and market liquidity in the immediate aftermath of a shock but also aim to exit from interventions as quickly as feasible. We show empirically that intervention effectiveness tends to be most obvious for 10–20 days after a shock. It is uncertain whether the central bank can hope to impact liquidity for longer timeframes, as fundamental drivers of market liquidity will become increasingly dominant. Adopting such realistic objectives can harness the benefits of providing support while managing potentially significant risks, including fiscal dominance, excessive market reliance on the central bank, and the financial risks associated with the central bank balance sheet.

Exiting from crisis intervention programs was harder for EMDEs compared to AE jurisdictions due to their less well-established track records in implementing such interventions. The case study analysis, and a comparison of EMDE central banks' exit experiences post-COVID-19 with those of advanced markets highlight unique challenges for EMDEs. A key issue is that EMDE central banks have less experience using such intervention tools to support markets compared to more commonly used interventions in money markets via OMOs or FX markets with spot market interventions. This means that markets are not so well versed in what to expect from EMDEs as they try and scale back support, making it harder to pull back and let markets manage flows and risks for themselves.

EMDEs should work hard to clearly delineate market support programs from those directed at providing monetary accommodation. The tendency to mix objectives and use one tool to try and achieve multiple goals with differing time horizons complicates exit. Interventions to support market functioning should be much

¹⁶ This principle aligns with the focus of earlier research on design principles for central bank interventions in securities markets in advanced market jurisdictions (for example, King et al. 2017).

shorter lived than interventions aimed at providing monetary accommodation or supporting the flow of credit to parts of the economy (such as the government). Exiting interventions and ensuring operations are easily understood can be more straightforward if EMDE central banks distinguish interventions aimed at market functioning from other types of operations. Such a delineation can be achieved by employing modalities tailored to support market functioning (for example, larger, more frequent operations targeted at benchmark instruments) and by establishing intervention triggers that align with the operations' role in supporting the market. Importantly, the objectives of market functioning operations need to be clearly separated from other potential objectives (for example, monetary accommodation or government financing support considerations). Trying to use one tool to crack multiple nuts may not be advisable.¹⁷

Risks, particularly those related to interventions in long-term debt markets, should be carefully considered. Exiting from interventions in longer-term government securities (and bank bond markets in the case of Chile) was most challenging because these markets are less resilient even in normal times in EMDEs. In addition, intervening in government bond markets may increase pressure from governments for the central bank to act for longer than ideal to keep financing costs low. Also, balance sheet (i.e., interest rate) risks are relatively high in longer-term securities, which may pose a threat to central bank policy solvency long after interventions have concluded, especially if monetary policy needs to tighten quickly.

Attention should be paid to developing exit criteria and indicators that will help determine when the appropriate time comes to pull back from providing support. These criteria should be communicated at the outset of operations to appropriately guide expectations on how operations will proceed once market conditions begin to normalize. This should include criteria for scaling back new interventions and dealing with maturities of instruments accumulated through past interventions (the reinvestment approach). Effectively dealing with these matters should simplify the exit process when the time comes and ideally put market participants in a good position to judge for themselves when the central bank will be exiting.

Transparency arrangements should be robust to aid effectiveness and reduce exit risks. Frequently, EMDE central banks provided little information on the progress of intervention operations, sometimes due to concerns about being gamed by the markets. The maturity profile of assets accumulated by the central bank was often not regularly publicized. However, this approach must be balanced against drawbacks in terms of effectiveness (as it becomes harder for markets to determine the impact of central bank intervention support if the extent of interventions is not well understood) and in understanding the exit approach.

Money markets can be adversely impacted by the liquidity injected through intervention programs, especially if they are not already well-developed. While overall the analysis suggests that money markets in EMDEs generally emerged relatively unscathed from the large amounts of liquidity injected, there are instances where this was not the case. Markets seem more resilient if the starting point is one of robust liquidity and a diverse range of participants. Central banks should have a strategy to ensure that monetary policy implementation, transmission, and market development objectives are not undermined in pursuit of providing wider market liquidity support. Many EMDEs managed this effectively by adjusting their operational frameworks and appropriately calibrating their operations.

¹⁷ This does not imply that interventions, such as asset purchases, need to be directed to solely one goal. However, if multiple goals are to be followed, the design, modality, and communication of the interventions should be as separate as possible. A good example was during the COVID-19 period in the U.K., where initially, the focus of gilt purchases was on large, frequent operations aimed at supporting market liquidity. However, after a few months, the focus shifted to monetary accommodation, and a smaller, more regular, and well-telegraphed series of gilt purchases were implemented.

NBFIs need attention. Market-based finance is growing in EMDEs, which means that managing the market implications of liquidity mismatches in NBFIs is increasingly important. Central banks in EMDE jurisdictions, such as Chile and India, should understand the nature of liquidity mismatches in the NBFIs sector. Appropriate ex-ante regulation should aim to mitigate the risks of liquidity problems in NBFIs spreading to the core money and securities markets. Intervention strategies and tools should be designed to address potential ex post liquidity problems in the NBFIs sector, while carefully managing the moral hazard and over-reliance risks that are present in any central bank intervention.

Preparedness plays an important role in reducing implementation and communications risks. Preparedness, through a sufficiently flexible legal framework and operational readiness, is critical. EMDEs sometimes needed to develop new operations on the fly, which, while ultimately effective, often require some degree of trial and error. The legal framework should be sufficiently flexible to allow central banks to effectively intervene in any core market exhibiting liquidity stress.

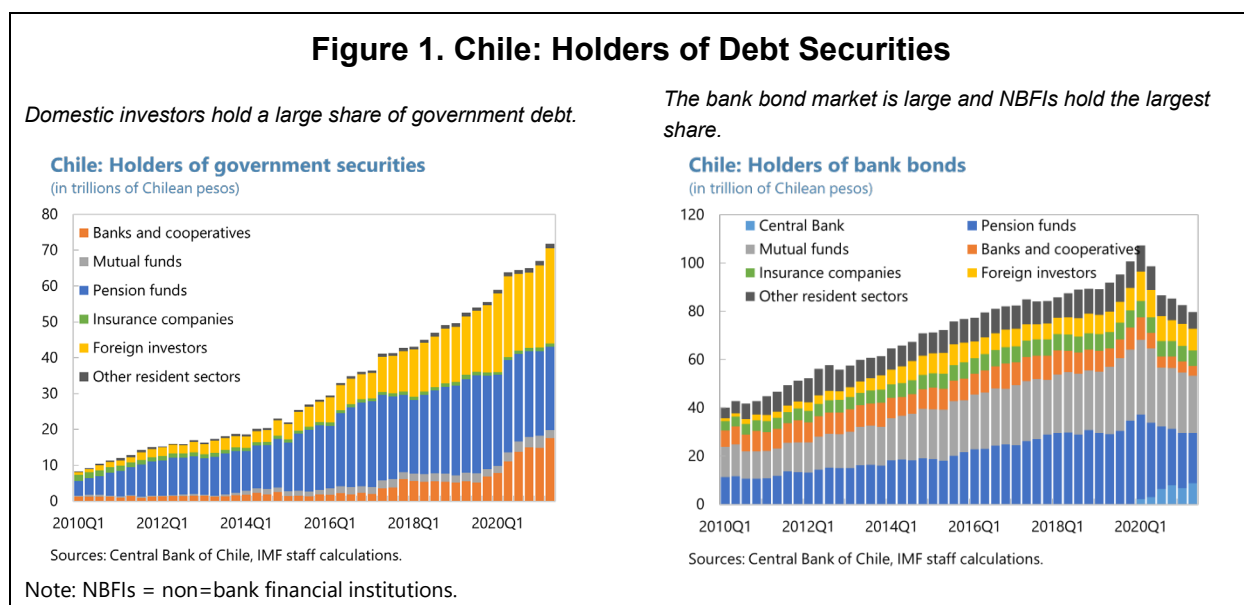
In some cases, interventions have significantly impacted central bank balance sheets and heightened risks. EMDE central banks need to turn their attention to shoring up their balance sheets to ensure their policy solvency and operational independence moving forward. EMDE central banks often significantly expanded their balance sheets, which will have implications for future sterilization costs. They often acquired riskier assets, such as longer duration government securities or bank securities, which will add to interest rate risks in the future. Balance sheet normalization—both reducing its size and changing its composition—will be required. In some cases, additional central bank capital will be needed to support the increased risks.

Annex I. Case Study: Central Bank of Chile

Context

The Central Bank of Chile’s (BCCh) COVID-19 crisis response followed earlier extensive support measures implemented during social unrest in November 2019. Chile faced two episodes of market disruption—one domestic and one global—in a short period that illustrate the costs and benefits of interventions in an EMDE with inflation targeting, a fully flexible exchange rate, and high central bank credibility.¹ Since the adoption of inflation targeting and a floating exchange rate in 1999, the BCCh has intervened in FX markets in only four exceptional circumstances: 2001, 2002, 2019, and 2022.² In late 2019, the central bank implemented liquidity and FX intervention programs following social unrest that provided timely and extensive liquidity to the FX and local money and securities markets. The subsequent COVID-19 shock saw the BCCh provide further support to markets.

Compared to many EMDEs, Chile has a relatively large bank bond market and non-bank financial sector. The bank debt securities market was almost double the government debt securities market at the end of 2019, supported by a deep domestic investor base. Mutual funds and pension funds are the most important providers of funding to the domestic banking system (mutual funds provide about half of time deposits) and pension funds are the largest buyers of bank bonds. Foreign investors play a lesser role despite increasing their holdings, particularly in government securities, in recent years (Figure 1). The BCCh did not intervene in the government bond market due to a prohibition on buying government debt or financing public spending until a legal change in August 2020.



¹ The BCCh became one of Latin America’s most transparent central banks after adopting inflation targeting and a free-floating exchange rate in 1999. It built strong credibility and maintained low average inflation despite the peso being a “commodity currency.” See IMF (2018).

² The BCCh also implemented three reserve accumulation programs, in 2008, 2011, and 2021, which were justified by the need to replenish buffers and not linked to disorderly market conditions. Additionally, it provided FX liquidity swaps during the global financial crisis.

Why Was Intervention Necessary?

The eruption of social unrest in late 2019 triggered substantial exchange rate volatility and flight to safety. Intraday FX volatility spiked, sovereign bond rates rose, and the Local Stress Index that captures various market functioning indicators rose sharply (Figure 2). Market stress reflected NBF1 portfolio reallocations away from banks and towards FX, which led to peso and FX liquidity shortages and stress on banks. The BCCh responded with a series of communications and market interventions in FX spot, funding, and peso money markets (see next section) that capped the cost of U.S. dollars in the forward market.³ The BCCh offered FX swaps at a 200-bps margin above normal market rates and had calmed markets by early 2020 without actually transacting significant volumes of swaps.⁴

The COVID-19 crisis in March 2020 saw a resurgence of market stress reflecting:

- **Exchange rate and FX funding pressures:** Capital outflows resulted in renewed pressure on the exchange rate and onshore U.S. dollar funding markets (albeit by less than that seen during the earlier period of social unrest). Both domestic and non-resident investors moved into short-term and USD denominated assets, which were perceived as more liquid.
- **Challenges in maintaining effective monetary policy transmission:** While policy rates were cut close to the effective lower bound, higher risk premia threatened to weaken transmission to longer-term rates. Transmission was further undermined by concerns that banks lacked sufficient collateral to access BCCh liquidity, and higher perceived credit risks reduced banks' willingness to lend. Bank funding markets came under pressure, as evidenced by wider credit spreads.
- **Portfolio shifts in the non-bank financial sector:** Pension and mutual funds withdrew from bank funding markets due to mutual fund redemptions and the Congress permitting pension fund investors extraordinary withdrawals to weather the COVID-19 crisis. These outflows severely impacted banks as NBFIs contribute about half of total bank liabilities. This was possible because Chile's bank bond markets are relatively well developed, and the NBF1 sector is large.⁵ NBF1 investment maturities shortened, which, coupled with increased dollarization within domestic investors' portfolios, significantly reduced banking sector liquidity.
- **Sovereign bond market pressures were less acute:** While liquidity declined in the government bond market, there were fewer concerns compared to bank bonds, as the government was able to use its sovereign wealth fund to finance its COVID-19 programs and did not need to suddenly increase government securities issuance. As Chile's constitution directly prohibited BCCh purchases of government bonds, intervention was not possible until a constitutional change in August 2020. In any case, such purchases were not required.

³ See also IMF (2021).

⁴ The outstanding amount peaked at \$1.1 billion in late November/early December 2019.

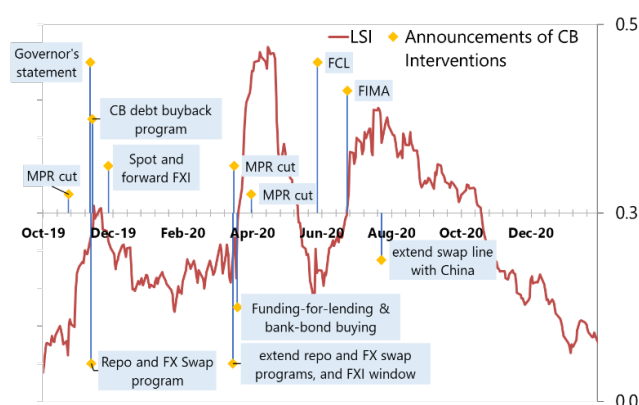
⁵ Initially, in July 2020, the government passed a bill to allow citizens to withdraw up to 10 percent of their pensions. In December 2020, and again in April 2021, two more withdrawals—each of another 10 percent—were authorized. In total, the equivalent of about 20 percent of GDP has been withdrawn from the pension system.

What Was Done?

The BCCh initially cut the policy rate and extended earlier market support programs, and then launched a bank bond purchase program. Key measures to support market functioning were:

- An extension of the prior **Repo and FX Swap programs**, initially until January 9, 2021, with additional maturities and an increase in daily volumes.⁶
- An **extension of the window for possible FX interventions** to January 2021.⁷
- The **inclusion of corporate bonds as collateral** in BCCh liquidity facilities.
- **A new bank-bond purchase program.** On March 20, 2020, the BCCh announced that it would buy bank bonds with up to five-year maturities at a premium to the local overnight indexed swap yield curve, based on the issuer's credit rating. The objective was to backstop the market and put a ceiling on yields. Purchases were limited to 20 percent of issuance per bank (later extended to 30 percent) and conducted via auctions.

Chile: Timeline of Key Policy Measures



Sources: BCCh, Haver, IMF staff calculations.

The BCCh also engaged in separate quantitative easing programs and increased its access to FX funding to strengthen Chile's external financing. These included a second "Special Asset Purchase Program," which encompassed the purchase of bank bonds and BCCh securities, totaling \$8 billion, and a funding-for-lending scheme.⁸ A new two-year IMF Flexible Credit Line was approved in May 2020 and access to the New York Federal Reserve's Foreign and International Monetary Authorities (FIMA) Repo Facility was arranged in June 2020. In July, Chile expanded its existing currency swap line with China. From January to October 2021, the BCCh accumulated additional international reserves.

Were Interventions Effective?

The BCCh succeeded in restoring the functioning of key markets. The Local Stress Index (above figure and Figure 2) shows that conditions normalized relatively quickly—especially in the FX funding market, which was well backstopped by the BCCh's FX interventions program and its policy credibility. External factors, such as a relatively limited impact of the shock compared to other emerging markets and global measures, likely

⁶ Repo operations were also offered at 7- and 180-day maturities, in addition to the existing 30- and 90-day maturities. FX swaps were also offered at 90- and 180-day maturities, in addition to the existing 30-day maturities.

⁷ The BCCh ultimately did not intervene in the FX spot market and merely rolled over expiring forward contracts until June 2020.

⁸ In March 2020, the BCCh introduced its funding-for-lending program for commercial banks to ensure the availability of bank credit to households and firms. Initially based on the Conditional Financing Facility for Increased Loans (FCIC1) and a Liquidity Credit Line Facility, the BCCh added two more facilities by early-2021. The overall funding-for-lending program reached about \$40 billion in total. These measures helped indirectly alleviate pressures in the bank-bond market by allowing banks to substitute bank funding through bond issuance and deposits with the FCIC1. As a result, the stock of both bank bonds and deposits fell.

played a significant role as well. Liquidity conditions stabilized, and the functioning of the bank bond market was maintained, with positive spillovers into other markets. Total bank debt outstanding fell as banks substituted private for central bank funding. Turnover in bank and government bonds rose as the shocks hit, but subsequently returned to normal levels. Market participants noted that the bank bond purchase programs helped corporate bond issuance and supported the government bond market.

However, the boost in excess reserves negatively impacted the interbank market. Interbank trading volumes plummeted as excess liquidity increased, and the interbank rate dropped to the floor of the BCCh's interest rate corridor (Figure 2). Some activity returned in the second half of 2020, but volumes remained well below pre-crisis levels. Overall, transmission remained adequate as the interbank rate realigned with the policy rate following the policy rate increase, and as activity picked up from the second half of 2020.

Exit Considerations

The design and prior experience with FX liquidity provision operations aided exit from FX funding market support. The BCCh included end-dates for its FX liquidity programs with each announcement. While these programs could be extended, the announcements created clear market expectations and a timeline for reviewing the ongoing need for intervention. This clarity aided the exit from FX interventions and the FX swap program. As exchange rate volatility and conditions in the FX funding market normalized, the stock of non-deliverable forward contracts gradually fell, reaching zero by end-October 2020. Similarly, the volume of FX swaps was reduced to zero by end-June 2020 despite FX swaps being available until January 2021. The pricing of FX funding support clearly established the facilities as backstops, which naturally liquidated as market conditions normalized.

Exit from the bank bond purchasing program was more prolonged. The bank bond purchases transitioned from crisis intervention measures to quantitative easing, serving as a mechanism to facilitate ongoing withdrawals from pension funds approved by the government. These mixed objectives complicated the exit strategy, as there was an ongoing need for monetary accommodation even after bank bond market conditions had normalized. Bank bond purchases were gradually discontinued as the BCCh decided to phase out QE. However, the BCCh opted to maintain a fixed stock of bank bonds, which were supported by a new "Bank Bond Reinvestment Program" in January 2021. When the policy rate was raised in mid-2021, the BCCh stopped the reinvestment of coupons and redemptions from bank bonds.

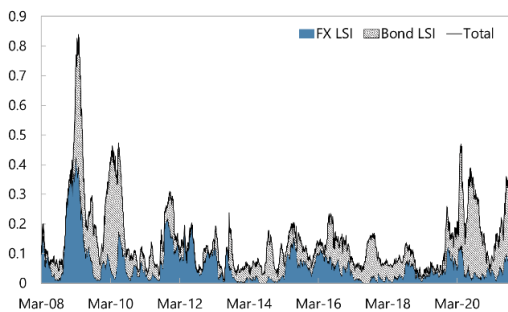
Some structural changes, such as reduced activity in the interbank and money markets, may persist. Activity in the interbank market collapsed as structural liquidity in the market increased through the implementation of the Conditional Financing Facility for Increased Loans, and it has since remained low. Additionally, the shrinking of the pension sector following withdrawals is likely to undermine money market activity for an extended period.

Figure 2. Chile: Indicators of Market Disruption

Markets had recently recovered from disruptions due to social rest when COVID-19 hit.

Chile: Local Stress Index

(Index values)

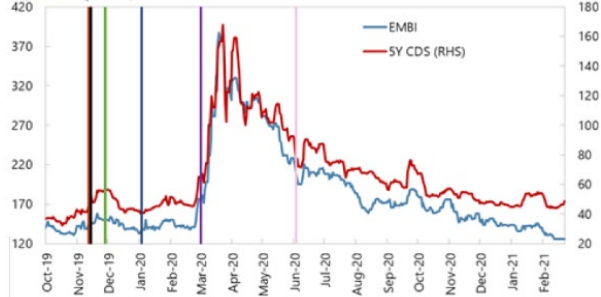


Sources: IMF staff calculations

The JP Morgan Emerging Markets Bond Index (EMBI) highlights periods of market stress as the COVID-19 shock hit.

Chile: EMBI Spreads and 5Y CDS

(In basis points)



Sources: Bloomberg and IMF staff calculations.

The exchange rate also spiked at the onset of COVID-19.

Chile: Exchange rate

(Chilean Peso/US dollar)

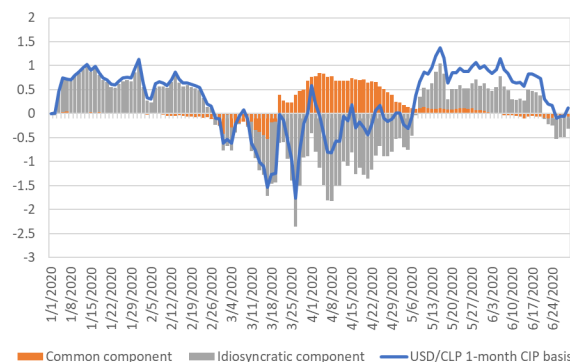


Sources: Haver, IMF staff calculations.

FX funding cost increased mainly due to domestic factors.

Variance decomposition of the USD/CLP CIP-basis

(basis points, cumulative changes)

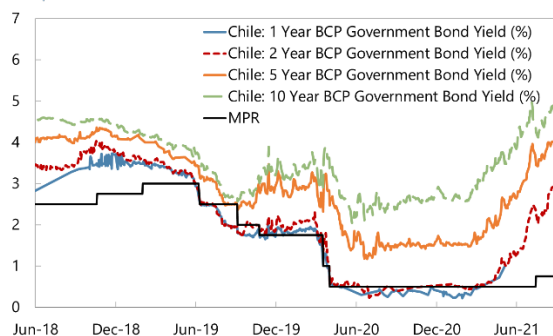


Sources: IMF staff calculations.

The yield curve steepened.

Chile: Bond yields

(in percent)

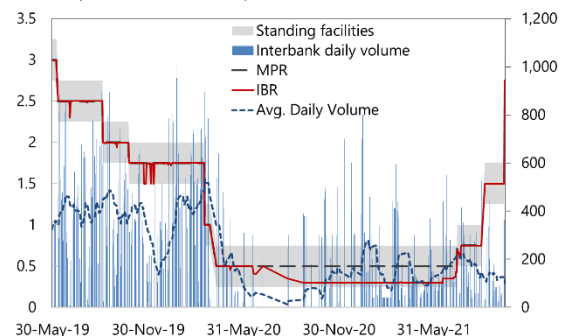


Sources: Haver, IMF staff calculations.

Interbank market activity fell with increasing excess reserves.

Chile: Interbank rate and transactions volume

(LHS: in percent, RHS: billions of pesos)



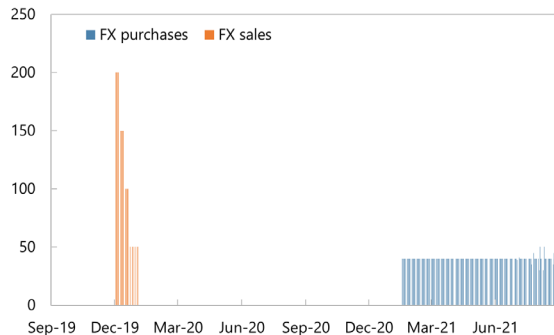
Sources: Central Bank of Chile, IMF staff calculations.

Figure 3. Chile: Interventions

FX spot intervention, which began in late 2019, was not deployed during the COVID-19 crisis.

Chile: FX intervention

(in USD millions)

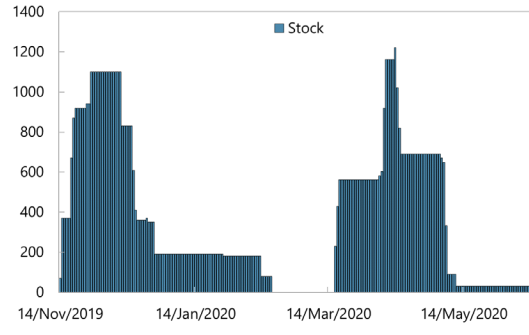


Sources: Haver, IMF staff calculations.

The demand for FX swaps subsided in May 2020.

Chile: FX swaps stock

(in million USD)

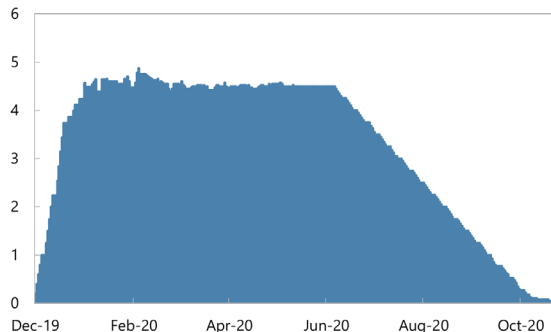


Sources: Central Bank of Chile, IMF staff calculations.

Non-deliverable forward contracts gradually rolled off the balance sheet.

Chile: Stock of Non-deliverable forwards

(in USD billion)

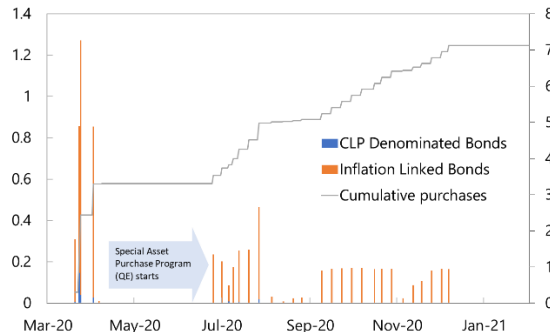


Sources: Central Bank of Chile, IMF staff calculations.

Bank bond purchases rose steadily.

Chile: Bank bond purchases

(in USD billion)

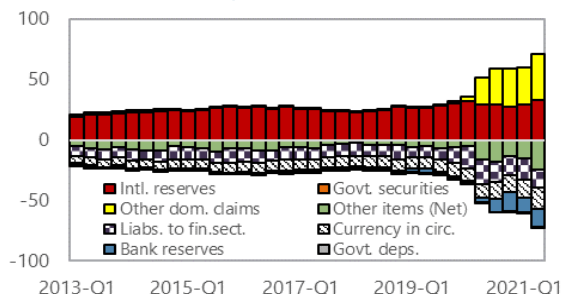


Sources: Central Bank of Chile, IMF staff calculations.

Bank-bond purchases expanded the Central Bank balance sheet substantially...

Chile: Central Bank Balance Sheet

(in trillions of Chilean pesos)

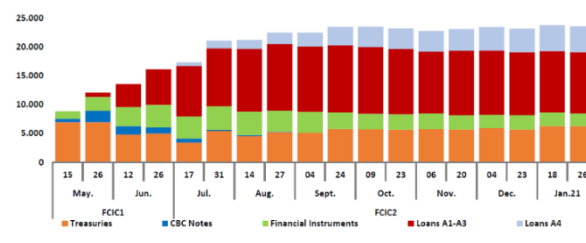


Sources: Central Bank of Chile, IMF staff calculations.

...and the collateral framework has broadened.

UMP evaluation (2): Broadening of collaterals for FCIC/Repo

Accepted collaterals by the Central Bank of Chile on loan operations (FCIC / Repo)
(USD millions)



Central Bank of Chile. A# is the risk classification for individual loans. The higher the # the higher the risk. FCIC3 will broaden to A5 - A6 with gov't guarantees.

Sources: Central Bank of Chile, IMF staff calculations.

Note: UMP = unconventional monetary policies; FCIC = financing facility for increased loans.

Annex II. Case Study: Bank Indonesia

Context

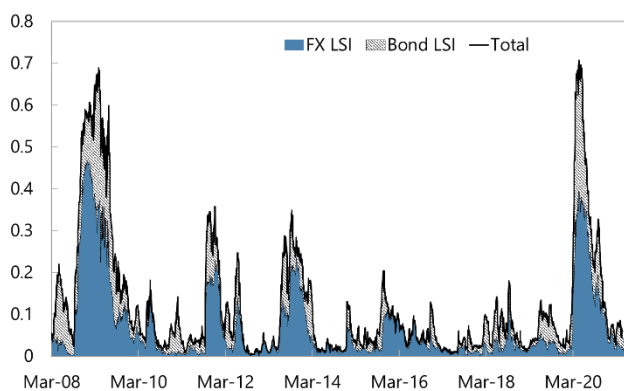
Bank Indonesia (BI) operates a free-floating exchange rate regime and saw a substantial increase in gross capital flows in the decade leading up to the COVID-19 crisis. BI intervenes frequently to support exchange rate stability, with the aim of promoting financial stability. It has actively implemented policies to support financial market development, improve the effectiveness of monetary policy transmission, and support financing for economic development. The monetary policy framework underwent a review, and the FX market was deregulated (Damayanti et al. 2020). The onshore and offshore FX markets have become more interconnected, which prompted the BI to introduce a new FX hedging instrument, the domestic non-deliverable forward, in 2018. This move aimed to reduce negative spillovers from the large offshore market (mostly non-deliverable forward) to the domestic spot market. Indonesia's high share of foreign investors in its local currency government bond market makes it vulnerable to reversals in capital flows. These investors predominantly participate in the government bond and equity markets, while their involvement in the corporate bond market is limited. The domestic investor base remains narrow, due to the underdeveloped pension and insurance sectors.

Why Was Intervention Necessary?

The COVID-19 crisis triggered a withdrawal of foreign investors, resulting in significant stress in Indonesia's financial markets. Foreign outflows in February and March 2020 amounted to \$2.1 billion and \$7.9 billion, respectively, and resulted in significant exchange rate depreciation (14 percent from February to end-March 2020) and wider bid-ask spreads in the on-shore FX market. The Local Stress Index (see figure) indicated the pressures were comparable to the Global Financial Crisis, particularly in the local government bond market. Foreign investors shifted from local-currency to foreign-currency denominated Indonesian debt and equities. This shift reduced the market's capacity to absorb additional government bond issuance in early 2020, due to a scarcity of domestic institutional investors and domestic banks' focus on increasing short-term liquid asset holdings.

Indonesia: Local Stress Index

(Index values)



Sources: IMF staff calculations.

What Was Done?

The BI promptly intervened to stabilize the exchange rate and to support the functioning of money and government bond markets. Measures included:

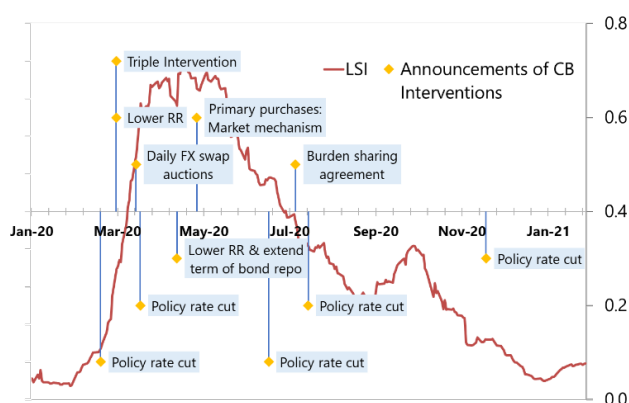
- **Lower policy rate.** The BI cut the policy rate by a cumulative 125 bp over 2020 to 3.75 percent, a historic low.¹
- **Reduced reserves requirements.** The BI reduced reserve requirements (FX reserve requirements were cut from 8 to 4 percent and rupiah requirements by 2.5 percent).
- **Increased liquidity provision.** The maturity of bond repos was extended up to 12 months.
- **More frequent FX swap auctions.** To boost FX liquidity, 1-, 3-, 6-, and 12-month auctions shifted from daily instead of weekly frequency.
- **A strategy of “triple intervention,”** including:

- **FX intervention:** Mainly through domestic non-deliverable forwards to manage exchange rate volatility. Such auctions were used to help protect international reserves.
- **Spot market FX interventions:** These were reflected in a \$9 billion fall in net international reserves in March 2020.²
- **Government bond purchases in the primary and secondary markets:** The BI initially bought around \$10.8 billion worth of government bonds from foreign investors in the secondary market. By late April 2020, secondary market purchases were replaced by primary market purchases using two methods: the “market mechanism,” where BI joined auctions as a non-competitive bidder, and a “burden sharing agreement” with the Ministry of Finance, where BI participated in private placements at below-market interest rates.

Bond purchases were motivated by the substantial increase in the government’s financing needs and concerns that markets would struggle to absorb the required additional issuance. The total allocation for the COVID-19 response under the National Economic Recovery Program amounted to 4.4 percent of GDP in 2020.³ Around half of these higher financing needs were met by foreign-currency bond issuances and from issuances to domestic banks. The BI ended up financing about half of the remaining deficit in 2020.

The BI prioritized communications on overall intervention objectives rather than on operational modalities. Ex-ante communication on size and exact timing of interventions was limited. However, the BI

Indonesia: Timeline of Key Policy Measures



Sources: BI, Haver, IMF staff calculations.

¹ The authorities were concerned that further rate reductions would lead to a surge in capital outflows, counteracting the objective of easier financial conditions. However, the BI ultimately cut the rate by an additional 0.25 bp in February 2021 to 3.5 percent.

² The BI replenished international reserves relatively quickly and supplemented reserves with several bilateral swap arrangements and repo lines with central banks and international institutions. This included accessing \$60 billion through the Federal Reserve FIMA repo line in April 2020.

³ Indonesia 2020 Article IV Staff Report.

maintained regular communication with both domestic and foreign market participants about its overall objective (to preserve market stability) and to gauge market sentiment.

Bond purchases were governed by additional risk management protocols. The BI established four risk management principles to cover its government bond purchases: (i) give priority to the market mechanism; (ii) consider the impact on inflation; (iii) purchase tradable and marketable bonds; and (iv) act as the buyer of last resort.⁴ Overall, primary market purchases amounted to IDR 473.4 trillion in 2020, of which IDR 76 trillion were carried out under the “market mechanism.”

Was Intervention Effective?

Markets started to stabilize in April 2020, but pressures persisted through mid-2020. Exchange rate volatility fell in April and May 2020 and bid-ask spreads in the FX spot market had normalized by June 2020. The BI continued using domestic non-deliverable forward auctions throughout most of 2020 and early 2021, but the volumes remained below the initial intervention in March 2020 (Figure 1). The decomposition of FX market pressures into common and country-specific factors suggests that although global conditions also contributed to the normalization, the bulk of the effect was country-specific, suggesting that the BI’s policies were effective in meeting their objective to restore stability (Figure 1).

Conditions in the government securities market also stabilized quickly, although pressures persisted for most of 2020. Bond market interventions helped mitigate the impact of increased bond supply on the market and kept government bond rates from rising. Nevertheless, the share of non-resident investors in local currency government bonds fell, despite an increase in absolute holdings. The BI purchases contributed to a fall in local currency bond yields and bid-ask spreads, and ultimately, to higher trading volumes in the secondary market (Figure 2).

Liquidity support to the money market pushed the interbank rate to the floor of the corridor and reduced interbank market activity. Excess reserves increased substantially, although the BI sterilized part of the excess liquidity through an increase in reverse repo operations. Amid the higher liquidity in the system, transaction volume in the interbank market halved compared to 2019 but fared relatively well compared to some other emerging markets.

Exit Strategy

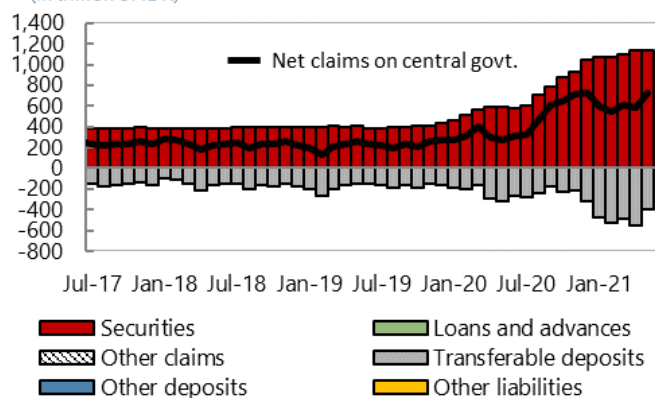
Bond purchases were extended into 2022, and the maximum quantity of bond purchases was increased as government funding pressures persisted. Purchases under the “market mechanism” were extended in December 2020 to help finance the 2021 budget. The burden-sharing agreement, initially set to expire at the end of 2020, was extended into 2022. These extensions in BI funding support to the government partially reflected the authorities’ view that fiscal support to sectors most affected by COVID-19, funded through monetary financing, was more effective than monetary accommodation via lower policy rates.

⁴ See Warjiyo (2021) for details.

The scale and extended timeframe of bond purchases raised concerns about fiscal dominance and risks to the BI balance sheet.

The initial phase of bond purchases eased financial conditions and supported market functioning. However, subsequent purchases aimed at providing budget support, combined with the lack of firm exit conditions, heightened the risk of fiscal dominance. The authorities have tried to manage these risks by emphasizing the temporary and extraordinary nature of the measures and their intentions to reduce the budget deficit to a maximum of 3 percent of GDP in 2023. Total public debt remains manageable at about 40 percent of GDP. The significant expansion of the BI's securities holdings has increased its financial risks. Sources: Bank Indonesia; IMF staff calculations.

Components of Net Claims on Central Government
(in trillion of IDR)



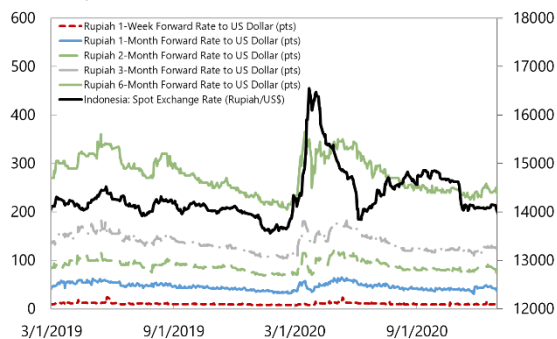
Key Lessons and Implications

The Indonesian case highlights the challenges to market functioning during a global shock by an EMDE heavily reliant on non-resident financing. The BI expanded its toolkit to manage FX volatility successfully. Managing liquidity pressures in the government bond market led the authorities to use new tools, including primary and secondary market purchases. These interventions were effective in improving bond market liquidity, although liquidity conditions remained strained for some time as government financing needs increased. The BI was pulled into pursuing multiple objectives, including backstopping the government's needs. This complicated the exit from bond market interventions as it required a much longer-term engagement than initially required for addressing market dysfunction alone. BI's interventions adversely impacted the money market by significantly increasing excess liquidity. Consequently, the BI will need to take steps to realign the interbank rate with its policy rate and sterilize excess reserves to incentivize interbank market trading activity. The BI's larger and longer-duration government bond portfolio will require careful management of associated balance sheet risks and potential fiscal dominance risks.

Figure 1. Indonesia: Market Developments and Bank Indonesia Interventions

The exchange rate depreciated by 18 percent in just 30 days...

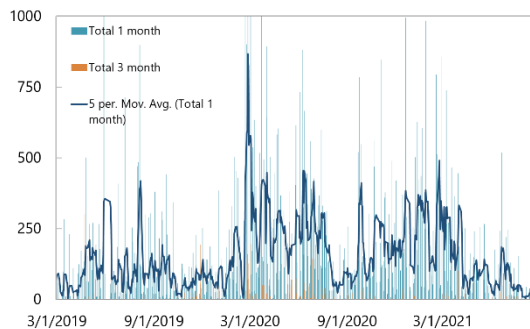
Indonesia: Exchange Rate
(Indian rupiah/US dollar)



Sources: Haver

...and FX interventions intensified.

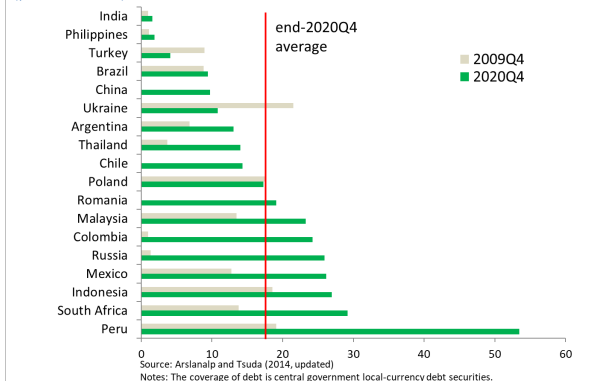
Indonesia: NDF auctions
(in million USD)



Sources: Haver, IMF staff calculations.

Foreign investors hold a large share of local currency government debt compared to other emerging markets...

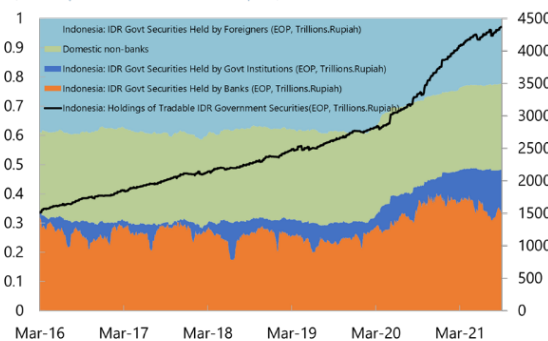
Foreign Holdings of Local-Currency EM Government Debt Securities
(percent of total)



Source: Arslanalp and Tsuda (2014, updated)
Notes: The coverage of debt is central government local-currency debt securities.

...but they did not expand holdings in line with debt expansion in response to the pandemic.

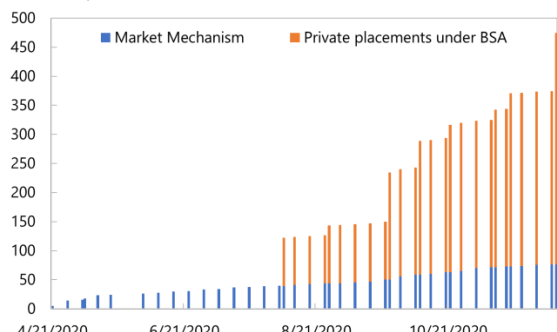
Indonesia: Holdings of government securities
(LHS: in percent, RHS trillions of rupiah)



Sources: Haver

Government bond purchases expanded.

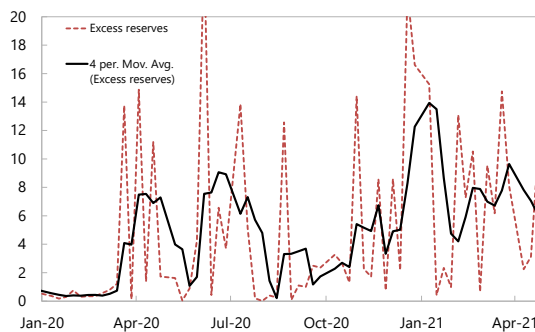
Indonesia: Cumulative bond purchases in primary market
(trillion rupiah)



Sources: BI, IMF staff calculations.

Liquidity also expanded.

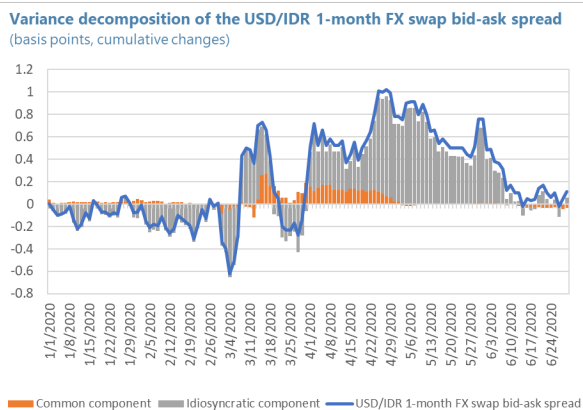
Indonesia: Excess Reserves
(in trillion rupiah)



Sources: Haver, IMF staff calculations.

Figure 2. Indonesia: Intervention Effectiveness Measures

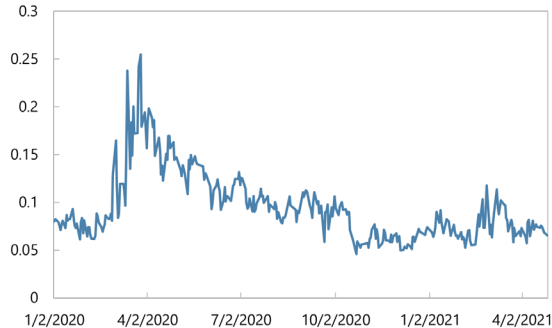
FX market pressures subsided in June 2020.



Source: IMF staff calculations.

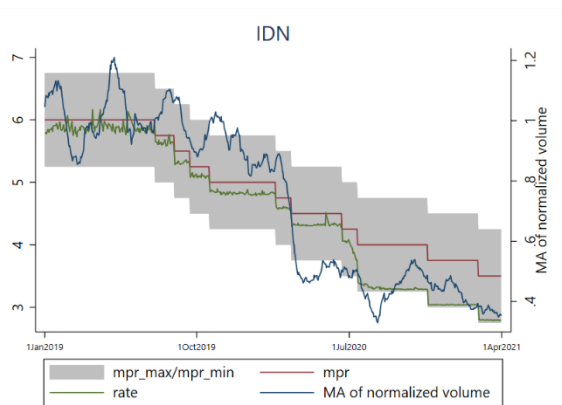
Bid-ask spreads on government bonds remained elevated for most of 2020.

Indonesia: Government bond bid-ask spread
(percent)



Sources: Haver, IMF staff calculations.

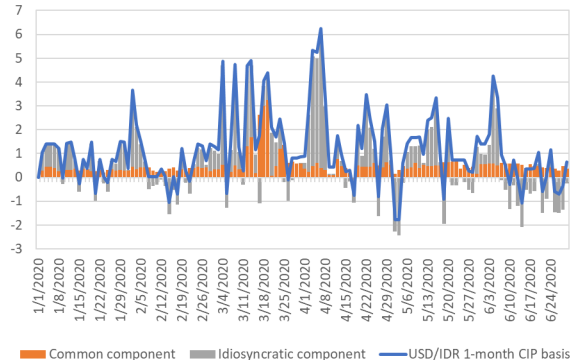
Interbank activity fell as liquidity increased.



Sources: Bank Indonesia, IMF staff calculations.

The covered interest parity (CIP) deviation did not suggest increased pressures on USD funding.

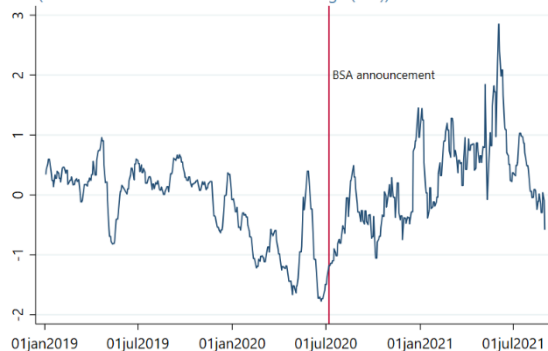
Variance decomposition of the USD/IDR CIP-basis
(basis points, cumulative changes)



Source: IMF staff calculations.

Government bond trading volume recovered with the onset of the burden sharing agreement.

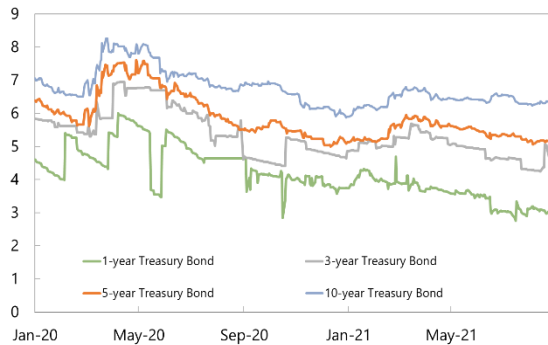
Cleaned transaction volume per debt outstanding
(In standard deviations above 2019 average (MA))



Sources: Haver, IMF staff calculations.

Yields normalized in mid-2020.

Indonesia: Bond yields
(percent)



Sources: Haver, IMF staff calculations.

Annex III. Case Study: National Bank of Poland

Context

Poland's fixed-income market is among the most developed of the EMDEs. The government bond and interest rate swaps markets are deep and liquid with a broad investor base. Most trading occurs in long-dated, on-the-run (most recent) bonds, while floating rate instruments and short-term bonds are mostly held by domestic banks for balance sheet management purposes. Non-resident investors are active, but their share in the bond market has decreased from about 40 percent in 2014 to 15 percent in 2021. Domestic banks are the main holders of government securities and are active market makers, with most trading occurring via over-the-counter inter-dealer brokers. In contrast, the agency bond market is relatively illiquid and lacks non-resident participation.

Poland entered the COVID-19 crisis with a comparatively strong economy and substantial fiscal buffers (IMF 2022b). The government aimed for a balanced budget, and the Treasury had already pre-financed about 73 percent of its 2020 borrowing needs when the shock hit. However, the constitutional debt limit of 60 percent of GDP required financing of some pandemic-related programs to be undertaken off the government's balance sheet. This influenced the design of the asset purchase program, motivating the National Bank of Poland (NBP) to purchase state agency bonds as opposed to government bonds alone. The NBP implements monetary policy via a mid-corridor interest rate system and uses open market operations to align the overnight rate with the policy rate. With a structural liquidity surplus, the NBP's main operations involve issuing short-term bills to absorb liquidity.

Why Was Intervention Necessary?

Polish financial market liquidity deteriorated rapidly in March 2020 due to the worsening global COVID-19 situation and resulting spillovers. As with other emerging markets (see IMF Global Financial Stability Review October 2020), the deterioration in the local bond market was more acute compared to the FX market (Figure 1). While the Polish zloty depreciated by about 6 percent against the euro in March 2020, FX market volatility was lower than during the 2008-2009 global financial crisis and the 2011 European debt crisis. FX funding markets saw some spillovers from global dollar demand, but the extent of idiosyncratic stress was limited, as evidenced by only a modest widening of the CIP basis against the euro (Figure 1).

The banking sector liquidity surplus limited the propagation of stress in the domestic money market. Increased demand for short-term funding, driven by foreign investor outflows, led to pressure in the short-term deposit markets (Figure 1). Additionally, some banks also faced liquidity outflows due to deposit withdrawals, and certain non-bank financial institutions experienced liquidity shortages from investor redemptions. Without direct access to NBP facilities, fund managers needed to raise liquidity through sales of government securities, particularly floating rate notes, which were even more illiquid than fixed-rate instruments.

The domestic government bond market largely came to a standstill in mid-March. Interbank dealers faced increased bond supply both from non-resident investors and domestic asset managers, leading to a one-sided market (Figure 1). Sharply increased volatility drove investors to reduce portfolio risks, reducing market liquidity. Additionally, the COVID-19 shock brought unique operational challenges and uncertainty around the ability to execute trades in a state of a total lockdown. Interbank brokers and the MTS trading platform, where

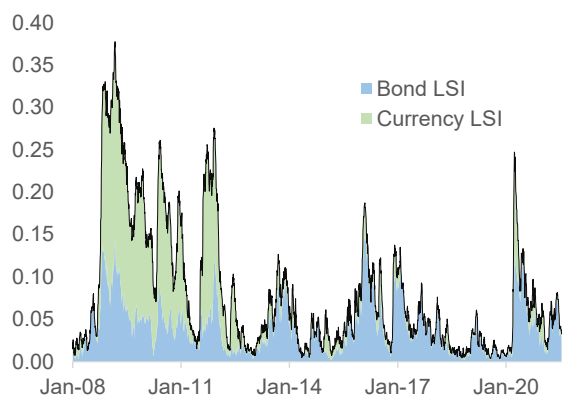
primary dealers are obliged to provide prices, saw only occasional price quotes. Bid-offer spreads in the government bond market widened from 2 bps to 10–15 bps for small on-the-run bond transactions, and even more for less liquid bonds.

Limited capacity to absorb flows and poor price discovery meant that even small transactions were causing large price moves. Within a week, the 10-year government bond yield increased by 80 bps, which was mostly attributed by market participants to the widening of bond-swap spreads driven by rising fiscal risk premia. Given the turmoil in the secondary market, primary markets were also effectively closed, leading to the Treasury cancelling bond auctions.

Figure 1. Poland: Market Developments around the March 2020 COVID-19 Shock

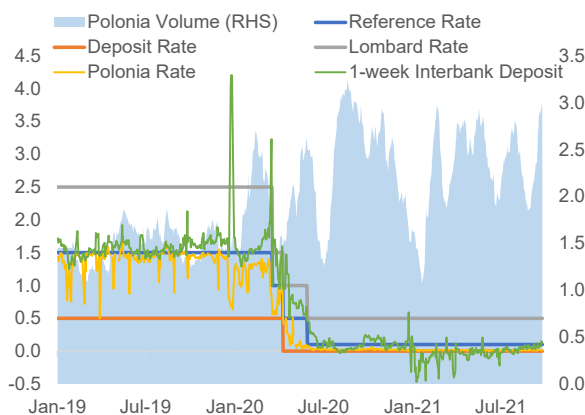
According to the Local Stress Index (LSI), the government bond market faced greater stress compared to the currency market...

Poland Local Market Stress Index
(index unit)



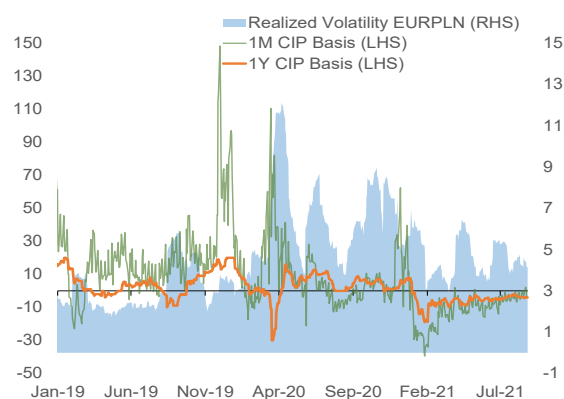
The money market benefited from structural liquidity surplus and shift actions by the NBP...

NBP policy rates and money market indicators
(Percent and billions of Polish zloty)



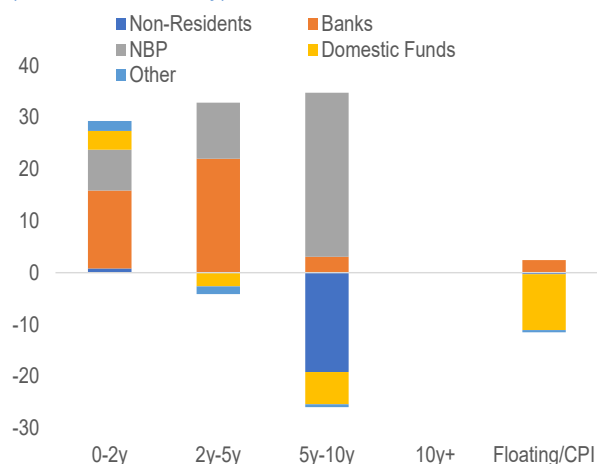
...as the idiosyncratic volatility and funding pressures for the zloty were more contained compared to previous crises.

Euro/Polish zloty (PLN) volatility and CIP basis
(Basis points and % per annum)



... although non-resident and domestic NBFIs sector outflows created liquidity and bond market pressures.

Bond ownership change in March-April 2020
(billions of Polish zloty)



Sources: Bloomberg Finance L.P.; Haver; Ministry of Finance of Poland; National Bank of Poland.

What Was Done?

The initial NBP efforts focused on providing ample liquidity and restoring the smooth functioning of the secondary market for domestic government bonds. The set of policy steps outlined by the NBP's Management Board on March 16, and formally announced the following day at the irregular Monetary Policy Council meeting, included:

- A cut of the reference policy rate by 50 bps to 1.0 percent and the Lombard rate by 100 bps to 1.5 percent.
- Fine tuning repo operations.
- Reduction of the required reserve ratio from 3.5 percent to 0.5 percent.
- Secondary market government bond purchases program.
- Discount credit facility for non-financial corporate bills.

The NBP announced further support measures on April 8 when asset purchases were expanded to include government guaranteed bonds. These included securities issued by the National Development Bank and the Polish Development Fund. The NBP also delivered a surprise 50 bps reference rate cut to 0.50 percent on April 8, followed by another 40-bps rate cut on May 28.

The asset purchase program pursued multiple objectives. Aside from restoring and providing an ongoing backstop to the government bond market, the stated objectives also included a change in the long-term liquidity structure of the banking sector and strengthening of monetary policy transmission. While not mentioned as an explicit objective, market participants also viewed the purchase program as a tool to limit yield curve pressure resulting from elevated supply amid uncertainty about bond demand.

The rapid introduction of the Structural Open Market Operations (SOMO) program faced some initial operational challenges. During the initial auctions, market participants noted that some of the operational details remained unclear. Notably, the irregular timing of auction result announcements created uncertainty among market participants regarding their risk exposure. However, over time, the process gradually became more streamlined.

The NBP program had relatively high ex ante and ex post transparency. The initial auctions were announced ad hoc, but from April onward, a regular schedule was provided. The NBP also disclosed a list of bonds it intended to purchase and mostly indicated the auction size. It published the list, the amount, and the average price per bond after the auctions.

Was Intervention Effective?

NBP's timely liquidity provision helped to maintain the smooth functioning of the money market while mitigating spillover risks to other domestic markets. The first and only bond repo operation, held on March 16, saw PLN 7.3 billion in demand, which was met in full. The cut in the reserve requirement ratio the next day helped to further boost the structural liquidity surplus, which also removed the need for subsequent repo auctions. Indirectly, the SOMO auctions also provided much-needed liquidity to domestic asset

managers,¹ thereby helping to avoid redemption failures and possible contagion effects at a time when some banks were already experiencing deposit withdrawals.

The launch of the SOMO program helped to restore bond market price discovery and moderated the surge in bond risk premia. Markets reacted positively to the initial SOMO announcement, with the 10-year government bond yield declining by about 40 bps, mostly through asset swap tightening. However, market pressure resumed in subsequent days. Poland's long-term bonds started to outperform those of the Czech Republic, which did not conduct bond purchases (see Figure 2 and Arena et al. 2021). At the first SOMO auction, banks offered PLN 3 billion in securities, with NBP buying PLN 2.7 billion against the PLN 10 billion total limit. Despite the modest uptake, the auction facilitated market price discovery, leading to the normalization of bid-offer spreads thereafter (Figure 2).

With market functioning restored, the SOMO program transitioned to other objectives. Although the volume of bond purchases on March 26 and April 16 increased, their impact on the secondary market appears to be limited to a temporary increase in trading activity (Figure 2). This was likely due to offsetting primary market issuance by the Finance Ministry, which faced large financing needs amid a limited appetite. In the following weeks, the SOMO operations shifted to purchases of government guaranteed debt, with the total program reaching a large scale relative to the net bond supply.

Exit Strategy

The asset purchase program was scaled down in the second half of 2020, yet it continued to operate. Changes in banks' liquidity structures and a decrease in lending heightened the demand for government bonds, diminishing interest in SOMO auctions and reducing government bond risk premia (Figure 2). However, in February 2021, the rise in global bond yields coincided with the spread of a new COVID-19 wave in Poland, and the NBP responded by increasing the volume of purchases. Despite episodes of increased volatility, markets stayed orderly, although the capacity to absorb large outflows remained impaired as compared to the pre-COVID-19 period.

The NBP did not formally terminate the asset purchase program. The NBP governor indicated that the program was de facto concluded when the NBP raised its policy rate and reserve requirements at its October 2021 meeting.² References to the purchase program were removed from the NBP's monetary policy statement, but the SOMO program remained active. The total size of the asset purchase program amounted to PLN 143 billion, or 5.4 percent of GDP.

Key Lessons and Implications

Asset purchases can support market functioning even when carried out in small amounts. During the market stress, NBP purchases aided price discovery and served as a reference for the secondary market. However, asset purchases are just one factor in determining the bond premia, and expectations need to be managed in terms its effectiveness in risk-premia compression if market imbalances persist. While large-scale

¹ The NBP did not accept floating rate notes. These had to be first switched to short-term bonds before being offered to NBP. The Ministry of Finance carried out a switching auction to provide fixed-rate paper for floating-rate paper.

² The reserve ratio increase was effective from November 30.

purchases seemed to have influenced Poland's bond risk premia over the medium run, their relative contribution vis-à-vis other factors, such as private credit dynamics, needs to be assessed separately.

Operational readiness is crucial for a smooth and timely rollout of support measures in crisis times.

The preparation of the intervention framework, systems, and communication strategy, either as standalone initiatives or as part of other existing operations, should support dealer participation and, consequently, the effectiveness of interventions. Poland's case also illustrates that liquidity bottlenecks may occur in the NBF1 sector. As such, central banks may need to expand their eligible counterparties to ensure effective liquidity provision to the impacted sectors to mitigate contagion and spillover risks.

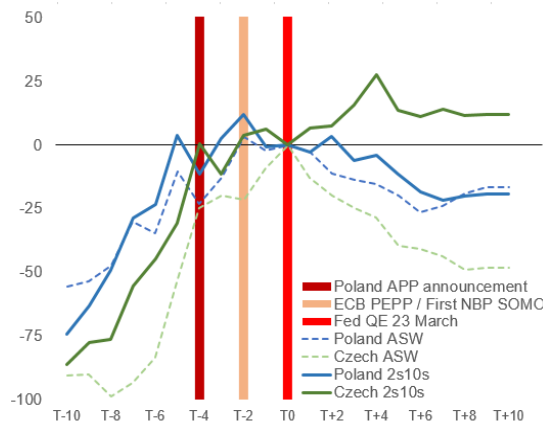
A transparency and communication strategy should be a central element of program design. While the NBP's program had a relatively high level of ex ante and ex post disclosure, additional details, such as the range of prices for purchased bonds, would have further enhanced transparency. This was also relevant for the SOMO auctions carried out in April 2020, which raised concerns about market segmentation. While secondary market purchases are recommended even during times of stress, primary market purchases might be considered to address short-term financing needs in rare circumstances and subject to appropriate safeguards (Adrian et al. 2021). Where legal constraints require potential workaround to address primary market failures, a high level of transparency should help to maintain the overall credibility of the program.

Multiple objectives and lack of clear anchors may complicate the exit from the purchase program. The on-and-off nature of bond purchases in 2021 effectively converted the SOMO purchases volume into a policy signaling tool, which may not have been intended. More explicit forward guidance could have reduced this uncertainty and therefore market turbulence. As NBP interventions extended beyond merely supporting market functioning, announcing a predefined purchase limit and the anticipated duration of the program could have served as useful yardstick for both the NBP and market participants, aiding in preparation for an eventual exit—even if these targets were subsequently revised due to changing conditions. While planning in the early stages of crises could be difficult, disclosing information in the ex-post communications can guide overall policy normalization.

Figure 2. Poland: Intervention Effectiveness Measures

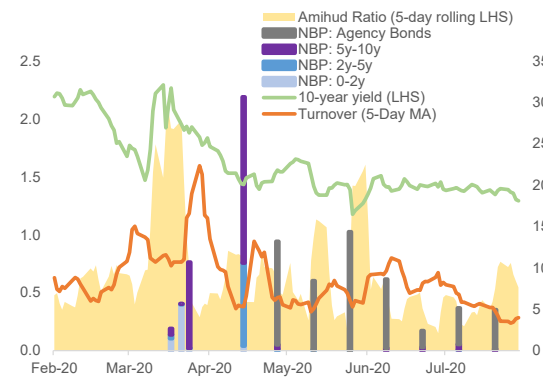
Poland's bond curve reacted positively to NBP interventions, outperforming the Czech Republic's during the same period.

Bond market premia during COVID-19 shock
(basis points)



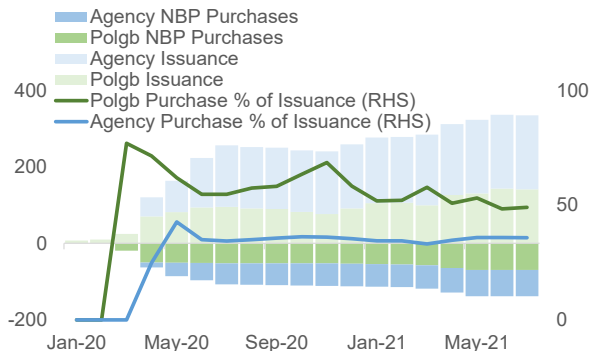
The subsequent SOMO auctions' impact on secondary market functioning is less clear...

NBP Purchases and market indicators
(Percent and billions of zloty)



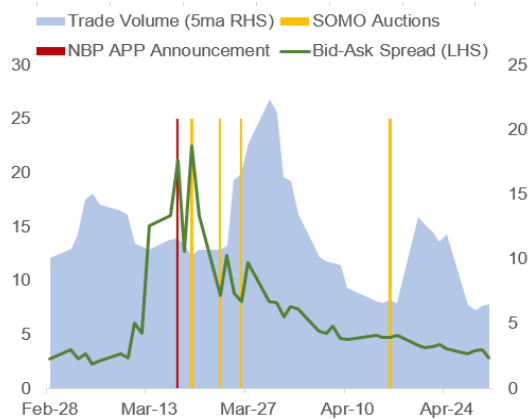
NBP purchases in the secondary market have absorbed a large portion of COVID-19 debt issuance.

NBP purchases and MoF issuances
(billions of Polish zloty and percent)



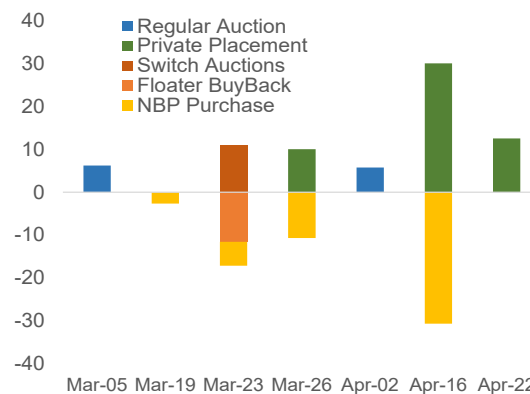
Bid-offer spreads started to tighten following the first structural open market operations (SOMO) auction.

Bond market liquidity during COVID-19 shock
(basis points and billions of zloty)



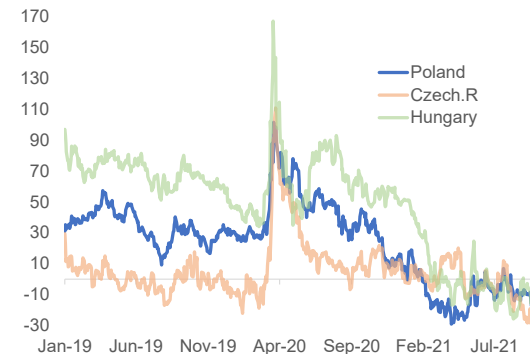
... as the NBP purchases were offset by a large bond placement by the Ministry of Finance (MoF).

NBP purchase and MoF issuance
(in billions of zloty)



Coupled with the change in the banking liquidity structure, the purchases supported government bond valuations.

10-year government bond swap spread
(basis points)



Sources: Bloomberg Finance L.P.; Haver; Ministry of Finance of Poland; National Bank of Poland.

Annex IV. Case Study: Reserve Bank of India

Context

India's bond market is well-developed, featuring a wide variety of traded instruments. Government securities are most common and serve as a credible benchmark for pricing other instruments, including corporate bonds. The government securities market is dominated by domestic commercial banks and insurance companies, with negligible holdings by non-residents due to limitations on securities ownership and regulatory requirements. Most trading occurs within the Negotiated Dealing System Order Matching system, with liquidity concentrated in on-the-run (most recent) bonds.

The rupee is fully convertible for current account transactions but has tight capital account restrictions. Speculative and hedging activity mostly occurs in the non-deliverable forward market, with only onshore banks accessing both deliverable and non-deliverable markets. The rupee is free-floating, with occasional interventions by the Reserve Bank of India (RBI) to mitigate volatility. Money markets are relatively developed, with activity concentrated in the short-term interbank markets that serve as a reference for pricing other term instruments, including commercial paper. The RBI operates an interest rate corridor system and uses repo operations, standing facilities, reserve requirements, and structural liquidity requirements, with the call market rate trading near the bottom of the corridor.

India was vulnerable going into the COVID-19, partially due to stresses in the shadow banking sector that began in 2018. The RBI was easing monetary policy while the banking system experienced a structural liquidity surplus. Between February 2019 and March 2020, the policy rate was reduced by 135 bps, and special OMOs were introduced, involving simultaneous purchases of long-dated and sales of short-tenor government securities. Additionally, in February 2020, liquidity was provided through new Long-Term Refinancing Operations (LTROs).

Why Was Intervention Necessary?

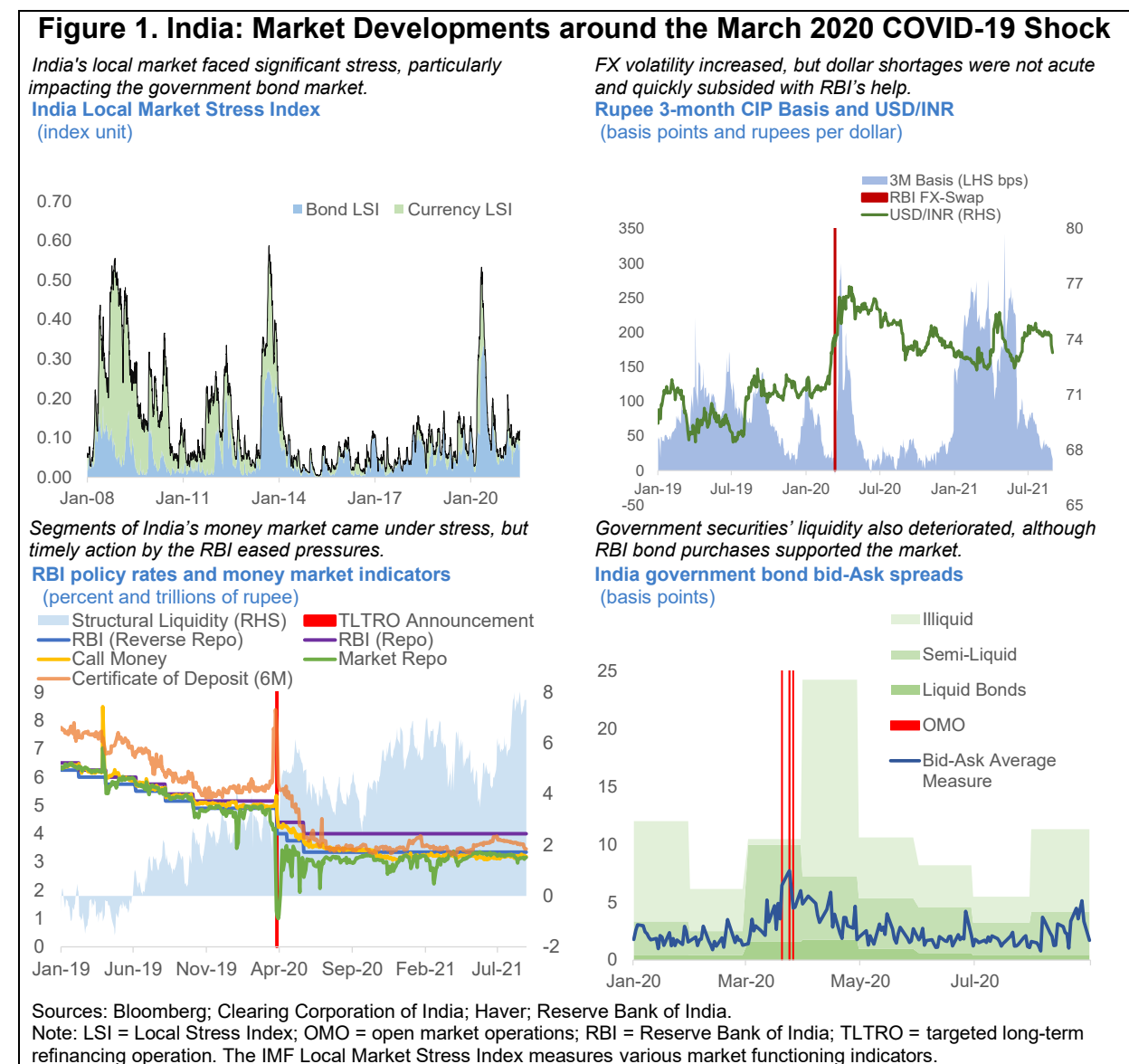
The COVID-19 pandemic arrived at a difficult time for India. First, pre-existing vulnerabilities in the financial sector meant that the shock was amplified through the credit risk channel, generating contagion fears among some of the weaker institutions. Second, due to fiscal year-end effects, market liquidity conditions were exacerbated by a seasonal deterioration toward the end of March.

India's mutual fund industry was a source of market pressure. Faced with large client withdrawals, mutual funds were forced to sell liquid assets, such as government securities and corporate bonds, and reduce purchases of commercial paper and other money market instruments. These developments caused primary markets to break down, increasing funding pressures for non-bank finance companies. The closure of a group of mutual funds increased contagion fears.

Market stress increased rapidly around mid-March and was more acute in government bonds and some instruments with embedded credit risk (Figure 1). FX market volatility rose, and dollar funding pressures increased in early March—albeit by less than in previous crisis episodes. While the overnight money market continued to function, credit market interest rates, such as certificates of deposits and commercial paper used by regional banks and corporates, spiked significantly.

Government bond market liquidity dropped, and risk premia on the long end of the yield curve rose.

Market makers did not have the capacity to absorb large outflows, even for high-quality assets like government bonds. Moreover, risk appetite was reduced by uncertainty around the size of the government’s bond program to fund the COVID-19 response. Traded volumes fell, and bid-offer spreads widened, particularly for off-the-run and government securities (Figure 1). Long-term interest rates rose, resulting in a significant steepening of the yield curve.



What Was Done?

The RBI deployed a range of measures to combat the COVID-19 shock, including both conventional and unconventional tools, supplemented with forward guidance. Key measures were:

- FX-swap facility to provide dollars against the Indian rupee.

- Reduction of the policy rate by 135 bps and widening of the policy corridor by 40 bps.
- Scaling up of OMO and Special OMO purchases of government bonds.
- Liquidity injections through existing term repos and a 100-bps cut to the cash reserve ratio.
- Scaling up of existing long-term refinancing operations (LTROs), and new targeted LTROs providing funding for up to three years.
- Special Lending Facility for Mutual Funds.

These measures aimed to restore market functioning and preserve confidence. The overriding goal was to provide ample liquidity to restore market functioning and underpin confidence. LTROs were focused on restoring monetary transmission and reducing the risk premia for corporate and non-bank borrowers most severely affected by the COVID-19 pandemic.

The RBI's operations were very transparent ex ante and ex post. Purchase limits and targeted securities for the OMO and Special OMO auctions were announced in advance, and detailed results, including information on demand, allocation data, as well as average and cut-off yields, were published afterward. The RBI also published a full set of results of its LTRO and targeted long-term refinancing operation (TLTRO) auctions. In April 2021, at the request of market participants, the RBI also started to disclose the OMO purchase envelope for the upcoming quarter.

Was Intervention Effective?

The proactive and well-targeted policy response helped to restore functioning across a range of markets. The RBI's \$2 billion FX swap auction was overbid by two times. Although not large, the FX swap auction effectively contributed to a swift recovery of the CIP basis. Term Repos and LTROs saw significant market demand, with the first TLTRO more than twice oversubscribed. These operations, along with the cut in reserve requirements, helped ease liquidity conditions and promote a sustained reduction in money market risk premia from March 27.

The RBI took multiple steps to stabilize the government bond market. Bond purchases at the end of March provided much needed liquidity and aided price discovery, helping normalize bid-offer spreads for more liquid securities (Figure 2). The LTRO and TLTRO operations also helped to anchor yields for the short-tenor bonds. However, traded volumes remained low and bond risk premia continued to rise in early April for long-dated securities. A more decisive turnaround in conditions occurred after the implementation of the special OMO operations on April 23 (Figure 2). Subsequent special OMO operations continued to have a consistent impact on the yield curve, effectively anchoring risk premia amid elevated bond supply.

Targeted liquidity provision operations helped to restore market confidence. In the second half of April, additional targeted liquidity measures were announced to support NBFIs and mutual funds. While the demand for TLTRO 2.0 and Special Lending Facility for Mutual Funds instruments fell short of their announced capacity due to already ample liquidity conditions, these measures effectively boosted market confidence. The RBI's commitment was evident through the stabilization and eventual improvement in commercial paper spreads and corporate bond spreads (Figure 2). Primary markets also recovered.

Interbank money market activity fell due to the increased liquidity associated with the RBI's interventions, but other money market segments fared better. Call money market volumes fell by about 50 percent compared to pre-COVID-19 levels, while activity increased in other money market segments (Figure 2). In most sectors of the economy, credit growth has stabilized but not yet recovered.

Exit Strategy

The RBI incorporated design features that allowed for the withdrawal of liquidity support as market conditions improved. LTROs and TLTROs were constructed with pre-announced program targets and allowed counterparties to prepay early if market conditions improved. Almost all LTROs and a third of TLTROs were repaid early in September–October 2020 as the RBI had cut rates and liquidity became abundant.

However, the RBI struggled to fully exit from providing liquidity support. The bond purchase program was scaled up after the initial COVID-19 shock, and the RBI introduced new floating rate on-demand TLTRO facilities until December 2021, despite market liquidity having improved. Starting in the third quarter of 2020, the frequency of special OMOs was increased to mitigate the impact on increased government bond supplies on long-term bond yields. Ongoing spillovers from U.S. bond market volatility and the ongoing COVID-19 shock, undermined government bond market confidence in the first quarter 2021. The RBI formalized increased bond purchases in April 2021 under its Government Securities Acquisition Program.

The Government Securities Acquisition Program was suspended in October 2021. However, the RBI retained OMOs and special OMOs, and the exit conditions for these operations remained uncertain, despite market conditions returning to normal. In addition, the RBI was expected to tighten monetary policy. The RBI's holdings of government bonds have increased by more than 60 percent since the start of the pandemic and have now reached about 7.5 percent of GDP (Figure 2).

Key Lessons and Implications

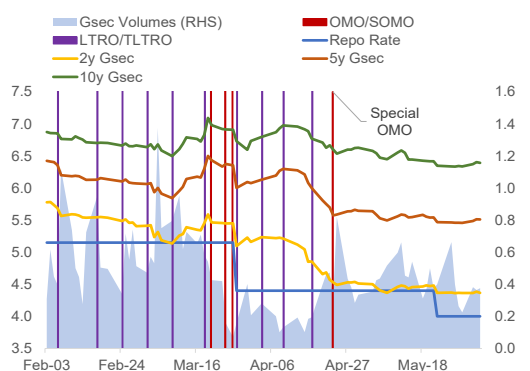
Targeted liquidity provision can effectively address market dysfunction. As market pressures and liquidity bottlenecks may occur in the non-bank financial sector or the corporate sector, targeted liquidity provision can be an effective way to restore market functioning and investor confidence. Quantity and duration-based targets, along with prepayment options, can also facilitate the eventual exit from the program. However, the effectiveness of these measures in fulfilling additional objectives, such as credit expansion, can be contingent on a multitude of factors, including credit guarantees, and needs to be assessed separately.

When faced with multiple objectives, asset purchase programs with separate targets can potentially boost effectiveness while assisting with program exit. India's experience confirms that market functioning can be restored with limited interventions. However, announcements on purchase quantities could be beneficial in the case of large-scale programs that have other objectives, such as risk premia compression, by moving the program from a reactive to a proactive state. The announcement of quantity and duration targets also served as a useful checkpoint for the Government Securities Acquisition Program reassessment and facilitated exit guidance. Although market expectations were skewed towards an additional program tranche, the bond market reaction to the exit announcement was contained as market participants agreed with the overall assessment made by the RBI.

Figure 2. India: Interventions Effectiveness Measures

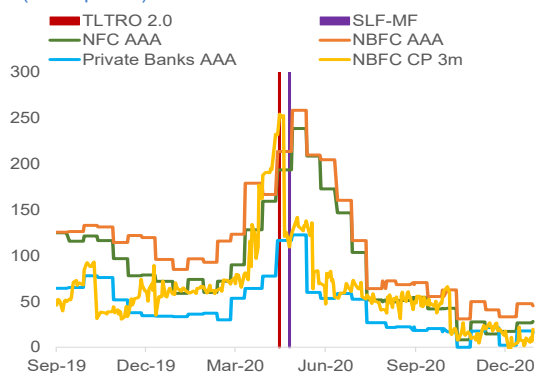
RBI's operations helped to stabilize the yield curve.

Government securities yields, trading volumes, and RBI measures (basis points)



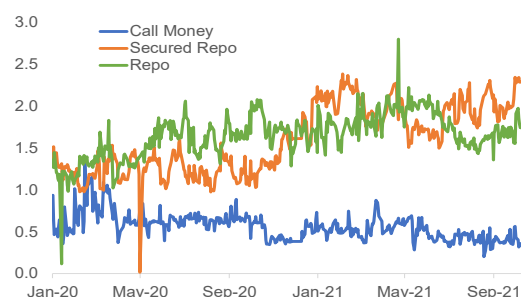
The ample liquidity and targeted support measures helped to restore market confidence in credit markets...

Corporate credit spreads (basis points)



The large-scale liquidity injections have partly transformed the activity in the money market...

Money Market Activity (ratio to 2019 average)

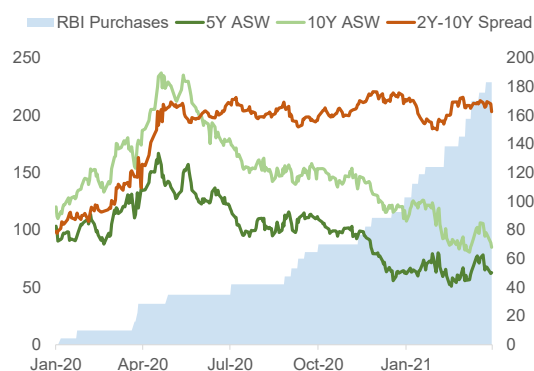


Sources: Bloomberg; Clearing Corporation of India; Haver; Reserve Bank of India.

Note: ASW = asset swap spread; GSEC = government securities; LTRO = long-term refinancing operations; NBFC = non-bank financial corporates; NFC = non-financial corporates; OMO/SOMO = open market operations/special open market operations; SLF-MF = Special Lending Facility for Mutual Funds; TLTRO = targeted long-term refinancing operations.

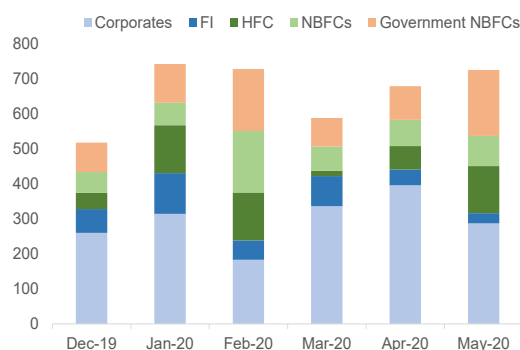
The long-end yield curve premia remains anchored amid a large increase in bond supply.

RBI purchases and yield curve premia (basis points and millions of DV01)



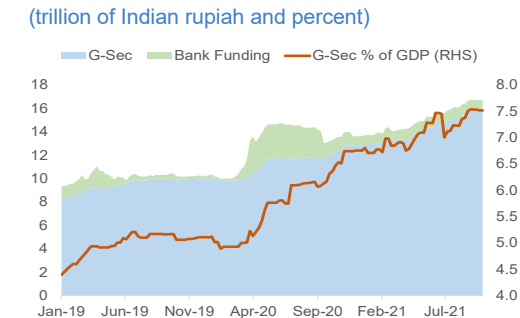
... while supporting primary market activity across a broad range of issuers.

Corporate bond issuance in local markets (billion of Indian rupiah)



... and while most of the bank funding instruments have rolled off, bond holdings continued to increase.

RBI Domestic Assets (trillion of Indian rupiah and percent)



Annex V. Case Study: Bangko Sentral ng Pilipinas

Context

Philippine local currency financial markets are at a relatively early stage of development, with domestic banks holding a dominant position. Foreign banks are also active, particularly those from regional Asian market hubs such as Singapore. The bond markets remain small, primarily comprised of government securities, with few non-bank institutional and foreign investors (Figure 2). Similarly, the money markets are undeveloped, although the authorities have pursued several initiatives in recent years, including in the government security repo market and the issuance of Bangko Sentral ng Pilipinas (BSP) bills. Recent reform of the operational framework, notably the introduction of an interest rate corridor, is expected to bolster money market activity. Treasury bills are the most active segment. Financial market infrastructures and regulatory frameworks are being reformed to facilitate more active markets.

The FX spot and swap markets are relatively more developed compared to the domestic markets, reflecting strong remittance and export flows. The implied peso interest rate derived from foreign exchange (FX) swaps is the most widely used money market benchmark. FX controls, including on borrowing in foreign currency, have limited FX mismatches in banks, NBFIs, and corporates.

The BSP's operational focus has been on sterilizing the large structural liquidity surplus arising from significant holdings of FX reserves. Although reserve requirements have been reduced in recent years, they remain high (12 percent) by global standards. The BSP has been transitioning to indirect instruments to sterilize liquidity through peso deposit auctions (since 2017), and more recently BSP bills. While liquidity provision is seldom needed, an overnight lending facility is available to banks.

Why Was Intervention Necessary?

Market conditions quickly deteriorated in March 2020, with indicators showing escalating financial stress due to a surge in the demand for precautionary liquidity. These indicators included:

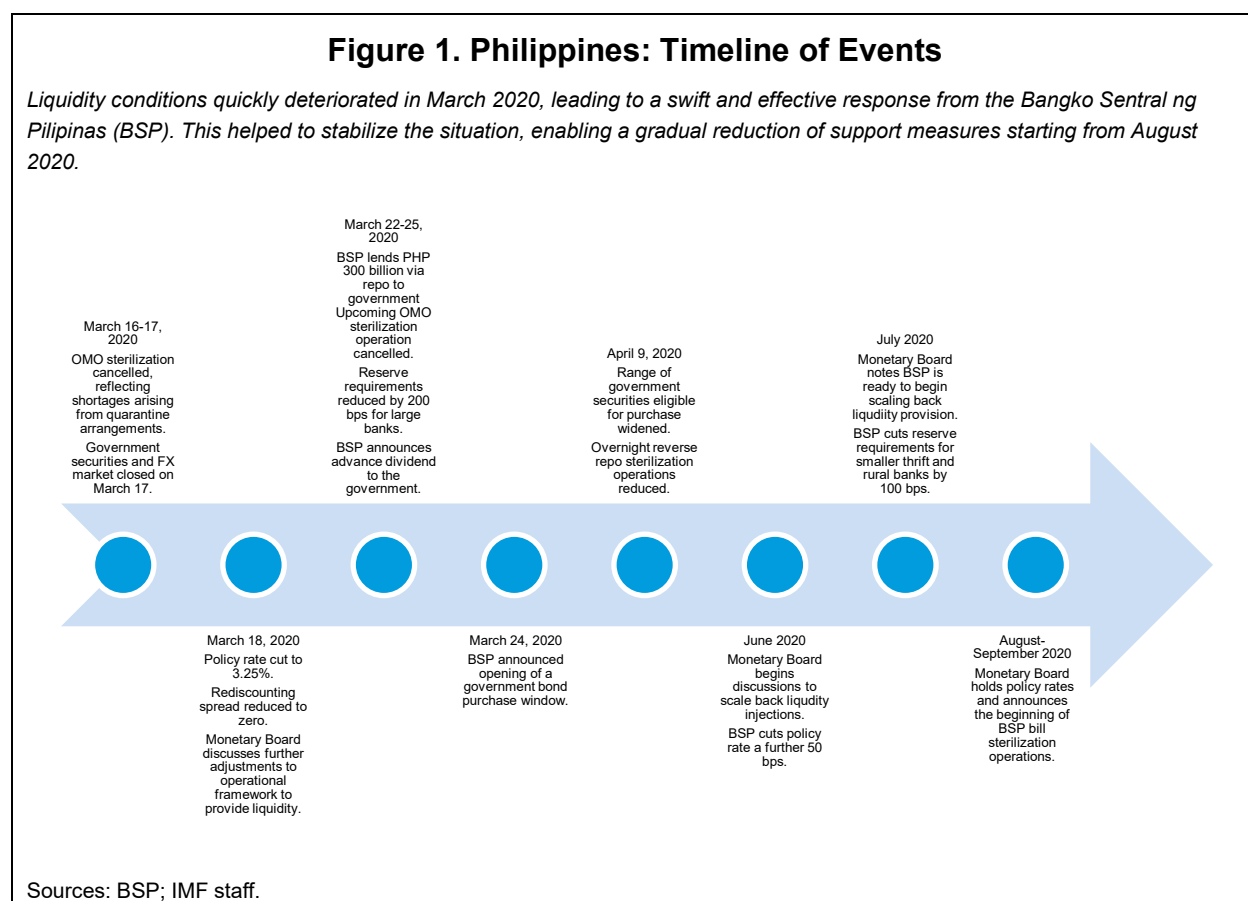
- A marked rise in short- and long-term interest rates.
- An increase in bid-offer spreads in the government bond market (spreads for standard parcel sizes increased from 10 to 50 basis points).
- Increased use of the BSP's standing overnight liquidity facility.
- Underbidding in the BSP's deposit auctions in March 2020.
- Settlement failures in government securities' auctions.

There was a growing expectation that the government would need to scale up its financing to support the COVID-19 response. Consequently, the government bond market became one-sided, and the exchange rate depreciated, accompanied by a weakening of the equity market, as expectations of economic weakness

reduced confidence. To forestall fire-sales and halt a downward-spiral of confidence, the authorities made the decision to close the financial markets on March 17.

What Was Done?

The BSP's operational response focused on supporting the government by providing liquidity through reduced sterilization and government bond purchases in the secondary market. The BSP implemented several measures to provide liquidity and support markets (Figure 1). Liquidity was provided by reducing both sterilization operations and reserve requirements, thereby equipping banks with more excess reserves to meet their increased precautionary needs. These measures were relatively straightforward to implement as deposit and reverse repurchase auctions were regular operations, and the BSP already had already reduced reserve requirements on a couple of occasions in recent years. Government bond purchases constituted a new operation, which, nevertheless, was quickly operationalized. The BSP also provided liquidity to the government via an advance dividend, a six-month repo line, and a 540 billion peso advance in October 2020. The latter two measures were subsequently extended.



The BSP was not required to provide FX liquidity support. FX market liquidity remained robust after an initial depreciation in the exchange rate, and there were no widespread FX shortages once it became clear that remittance inflows were not interrupted and that importers' demand for FX was curtailed due to the impact of the COVID-19 lockdowns. The authorities were successful in maintaining market confidence through prompt actions, and major central banks quickly provided liquidity in their own jurisdictions, which had positive

spillovers to the Philippines. The absence of significant FX liquidity mismatches and the relatively low footprint of foreign investors in the domestic markets likely also played a role.

Was Intervention Effective?

The BSP's actions quickly calmed markets. Interest rates fell significantly over April and May, and the yield curve flattened. Evidence of improved market functioning included narrower bid-offer spreads, more two-way bond trading, stronger support for government bond auctions, stronger demand for the BSP's sterilization operations, and a decrease in requests at the BSP's bond purchase window.

An adverse side effect of the injected liquidity was a significant decline in interbank money market activity. Once precautionary liquidity demand subsided, most market participants were on the same side of the market, resulting in limited trading opportunities (i.e., few participants were short of liquidity). Price discovery was compromised, leading to many days without significant trading volumes, which made it difficult to calculate an overnight reference rate. The Philippine Interbank Reference Rate peso implied that the FX swap market was larger than the interbank market and remained more actively traded during the post-intervention period.

Although market functioning was restored, there were fewer indications of robust monetary accommodation. The BSP entered the interventions with three related objectives: to restore market functioning, to provide liquidity to banks and the government, and to provide monetary accommodation to support credit demand. While the BSP was successful in restoring market functioning and providing liquidity to banks, credit demand remained weak. Drawing a definitive conclusion here is challenging, however, due to the absence of a counterfactual during the severe macro shock experienced.

Figure 2. Philippines: Market Developments and BSP Interventions

Markets faced a broad-based liquidity shock in mid-March 2020 as the COVID-19 situation worsened.

This was driven by a surge in domestic investors' demand for liquidity, rather than a reversal in capital flows,....

Philippine financial market indicators, 2020-21

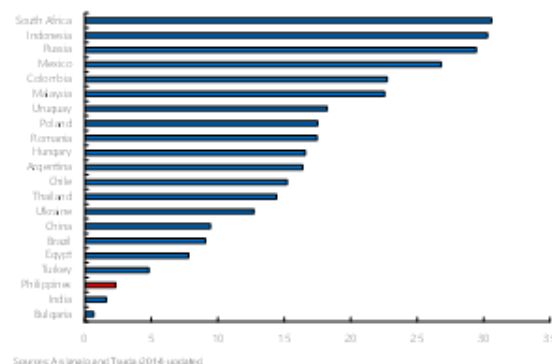
(Percent, USD/PHP)



Source: BSP, Bloomberg

Foreign holdings of local currency emerging markets bonds, 2020 Q2

(Percent of outstanding)



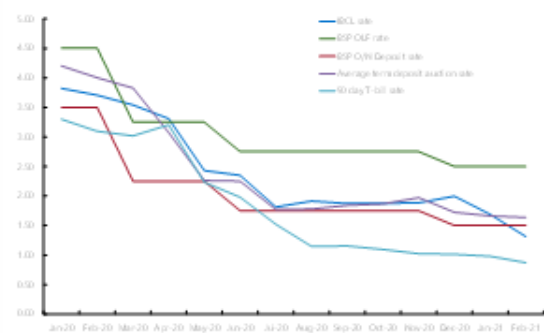
Source: Arslanagic and Tsai (2014) updated

prompting significant policy easing from the BSP,....

... and liquidity injections via reduced reserve requirements and OMO sterilization,...

BSP interest rate corridor and money market interest rates, 2020-21

(Percent)



Source: BSP

BSP Sterilization Instruments outstanding vs money market interest rates, 2020-21

(Percent, USD, Percent)



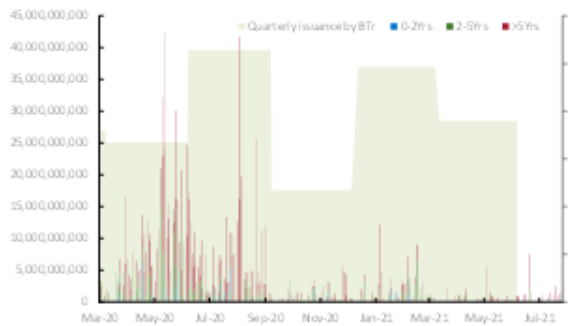
Source: BSP

... and government securities purchases.

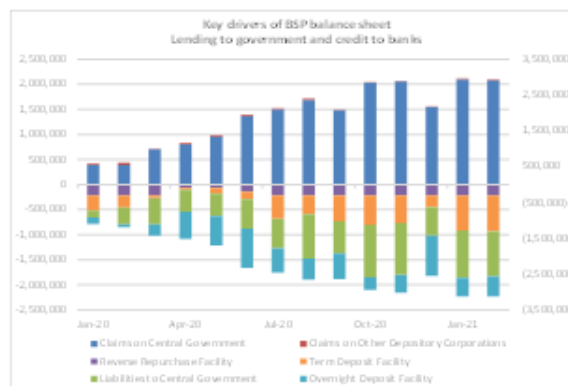
Market conditions normalized by May 2020, allowing for scaling back of BSP support.

Daily Government bond purchases by the BSP

(March 2020-August 2021, PHP)



Source: BSP, Asanbanchi online

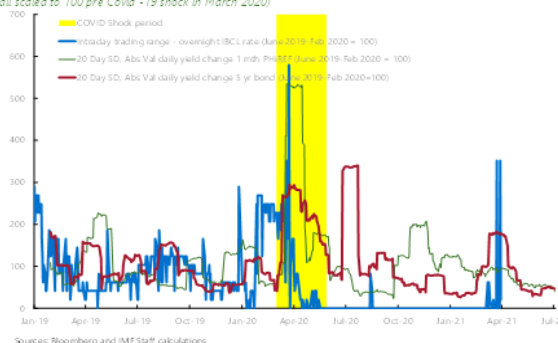


Note: BTr = Bureau of the Treasury; IBCL = issuing bank credit limit; OLF = overnight liquidity facility, O/N = overnight; PhiREF = Philippine Interbank Reference Rate.

Figure 3. Philippines: Intervention Effectiveness Measures

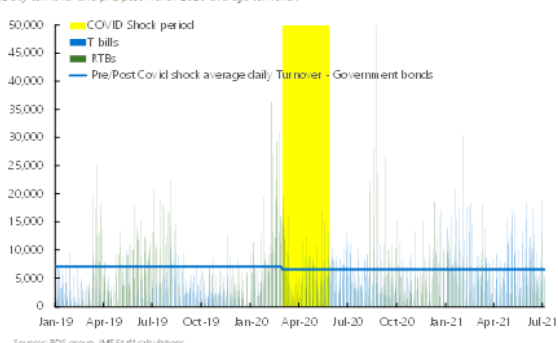
Money market interest rate volatility has diminished since the BSP injected liquidity in response to the initial COVID-19 shock.

Philippines interest rate volatility indicators - 2019-2021
 (Intraday trading range for IBCL, 20 day standard deviation of absolute daily yield changes for others, all scaled to 100 pre Covid -19 shock in March 2020)



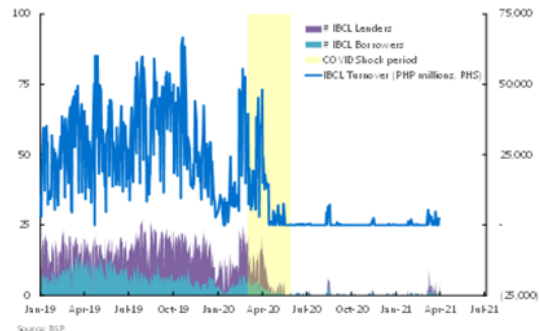
Government securities turnover is down modestly relative to before the initial COVID-19 shock...

Philippines government security daily turnover 2019-2021
 (Daily turnover and pre/post March 2020 average turnover)



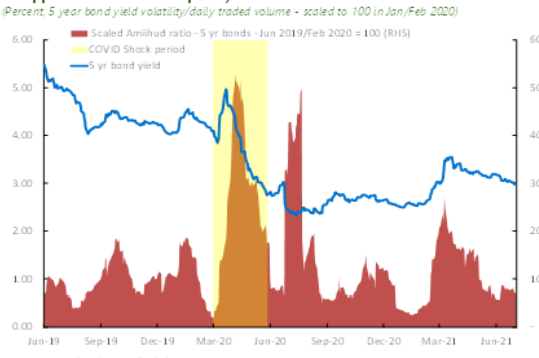
But broader interbank market liquidity indicators have not recovered.

Philippines interbank money market activity 2019-2021
 (Number of daily participants, Daily turnover, PHP millions)



But overall bond market liquidity has returned to normal...

Philippine bond market liquidity - Amihud ratio
 (Percent 5 year bond yield volatility/daily traded volume - scaled to 100 in Jan/Feb 2020)



Notes: IBCL = issuing bank credit limit; RTBs = retail treasury bonds; SD, abs. Val = standard deviation, absolute value.

Communication and Exit Strategy

The BSP employed a multi-pronged approach to communicate their interventions. Early in the stress period, the BSP extensively communicated the objectives and modalities of its interventions directly to market participants, supplemented by press releases from the Governor. Detailed intervention methods were discussed directly with market participants rather than being disseminated through public channels.

Ex post communication was less comprehensive. Although the BSP did not publicize the results of its daily bond purchase window, participants could infer the results from comprehensive post-trade data available on dealing platforms. For market participants to get a sense of the BSP’s operational stance each day, they regularly called for quotations and commentary on the status of the purchase window. For other operations, such as the structure and results of the BSP’s term deposits, reverse repurchases, and bill operations, announcements were made regularly in line with pre-COVID-19 practices.

The BSP was relatively transparent when scaling back support. The BSP board concluded by June 2020 that markets had stabilized sufficiently and began discussing scaling back liquidity support. These discussions, along with subsequent decisions to increase sterilization and re-introduce BSP bills, were publicly announced

and did not adversely impact markets. This stability was indicative of the significant reduction in precautionary liquidity demand.

Nevertheless, some uncertainty persisted as the BSP extended the bond purchase window beyond the initially announced six-month period. The BSP did not specify any criteria for withdrawing the facility, primarily communicating informally and directly with market participants when indicating a reduction in its purchases starting from August 2020. Consequently, to confirm whether the facility was still available, participants continued to regularly question the BSP on its status.

Key Lessons and Implications

The BSP was hampered by a lack of operational readiness to implement bond purchases. The BSP was able to quickly scale its preexisting instruments, such as term deposit auctions, but bond purchases were more challenging, often requiring mid-course operational adjustments. In some cases, operational modalities were chosen to facilitate faster implementation, albeit at the expense of transparency and perhaps effectiveness. An example was the bond purchase window, which could have been more effectively implemented as an auction but couldn't be introduced within the required timeframe. The BSP is exploring alternative modalities for future crisis situations.

Intervention objectives were mixed through time. Initially, it was relatively straightforward to target interventions at a range of objectives, as liquidity injections and asset purchases simultaneously achieved the multiple objectives of backstopping markets, providing liquidity, and monetary accommodation. However, the lack of clarity regarding which instruments were directed at each objective made it harder to scale back operations when markets returned to normal. This issue has particularly affected the bond purchase window, as market participants now perceive it is playing a role in backstopping government debt auctions and perhaps providing monetary accommodation. As a result, discontinuing the window has become difficult, despite the bond market liquidity conditions having normalized for some time.

With a bank-focused financial system like the Philippines, money markets are likely to remain impaired until more liquidity is withdrawn. These markets are not well-developed and are likely less robust to changes in the structural liquidity position arising from crisis interventions. Conversely, the more resilient peso implied FX swap market is consistent with a market that is more developed and with a more diverse set of participants. Although the BSP has scaled up sterilization since mid-2020, additional measures are likely needed to bring excess reserves closer to banks' precautionary demand, as witnessed in pre-COVID-19 period, in order for the money market to recover.

More comprehensive ex post communications could have boosted effectiveness and facilitated the path to the exit. While there was sufficient ex post information on some operations, such as term deposit auctions, BSP securities auctions, and reverse repurchase operations, the same transparency was lacking for the bond purchase operation. This likely reduced BSP's effectiveness in supporting price discovery. Although some information was available from trading platforms, market participants did not have a complete understanding of the volume of interventions and the pricing approach of the BSP. Additionally, the absence of such information has made it challenging to scale back the operation, as ongoing uncertainty persists regarding the availability of the facility. The use of ex post communications for bond purchases, like those used in other operations and within an auction structure, could have significantly alleviated these challenges and uncertainties. Clearer communication of the intervention strategy, objectives, and outcomes could have reinforced the overall effectiveness of the operation.

Annex VI. Case Study: South African Reserve Bank

Context

The South African Reserve Bank (SARB) operates as an inflation targeter with a floating exchange rate regime and an interest rate-based operational framework. During the crisis, the SARB targeted interbank money market rates using a 100-point wide interest rate corridor, maintaining a structural liquidity shortage that is offset at the margin through weekly repo operations.¹ The South African Benchmark Overnight Rate interbank rate typically lies close to the middle of the interest rate corridor, while the implied overnight FX swap rate is more variable and often in the top half of the corridor (Figure 1).

The South African Government Bond (SAGB) market ranks among the most liquid emerging markets, with substantial non-resident participation. At the end of 2019, non-residents held about 38 percent of the total outstanding amount of local currency-denominated government bonds, the third largest participation rate among major emerging market bond markets. The country's investment grade credit rating ensured steady foreign institutional investor demand until recently. Pre-COVID-19, the SAGB market was characterized by relatively tight bid-offer spreads and moderate volatility. The market structure is complex, and the regulatory framework comprehensive. There are well-functioning repo, asset swap, and FX derivatives segments. The daily average turnover in the bond market was around R140 billion in 2019, which increased to R153 billion in the first quarter of 2020, but fell below R80 billion by December 2020.

Banks have primary dealer roles and hold about 20 percent of outstanding government bonds as of end-2019, indicating a strong bank-sovereign nexus. The funding and liquidity levels of banks directly influence their participation in the SAGB market, which not only supports interest rate transmission but may also increase systemic risks in the case of liquidity shocks. Domestic pension funds held 25 percent of the SAGB market as of end-2019. This share is relatively small, reflecting a preference for alternative assets such as money market funds and negotiable certificates of deposit. South African banks maintain a sizable presence across the continent, which drives significant cross currency balance sheet management and funding flows.

Why Was Intervention Necessary?

The bond market experienced severe impacts simultaneously due to a sovereign rating downgrade and the COVID-19 crisis. Non-residents' share in local currency government bonds declined from 37 percent to 30 percent in 2020, marking the fourth largest selloff in major EMDE bond markets.² The yield curve steepened significantly in 2020Q1; 10-year yields increased from 9.5 percent to 12 percent, while two-year yields increased from 6.5 percent to 7.8 percent. Intraday trading ranges widened 10-fold from the average of 5–10 basis points earlier in the year. Bid-ask spreads widened from 2–3 basis points to 10 basis points. The Amihud illiquidity measure experienced a tenfold increase from its January level in March and rose by about 80 percent by the third quarter of 2020. The ZAR depreciated against the U.S. dollar by more than 15 percent.

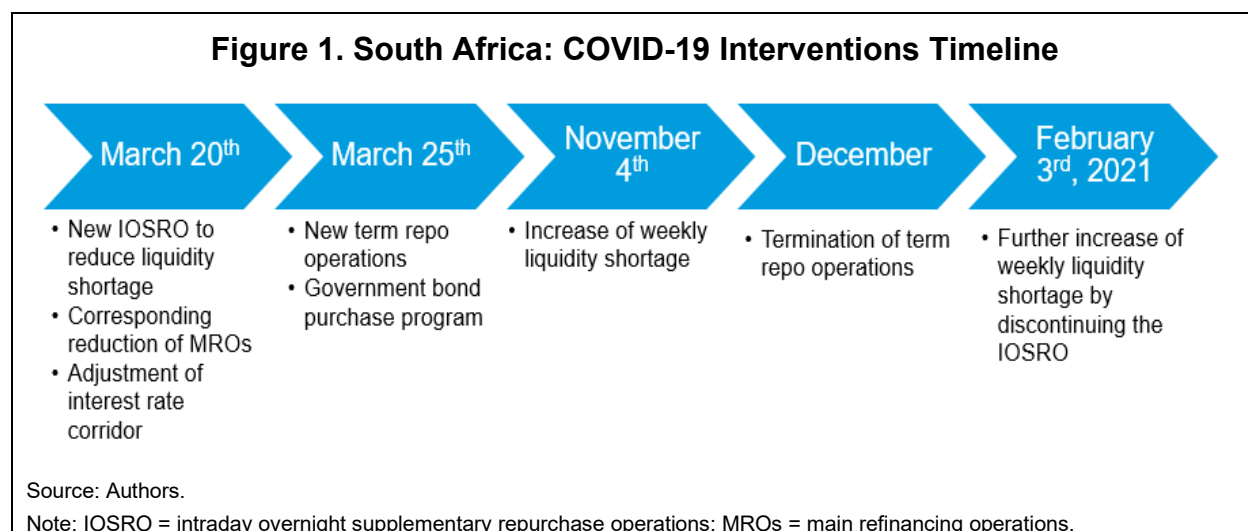
¹ The SARB modified its operational framework, moving to a tiered floor system in June 2022.

² Only Argentina, Indonesia, and Russia experienced a greater exodus of foreign investors.

South Africa’s exclusion from investment grade bond indices led to speculative investors becoming more dominant in the non-resident segment of the SAGB market, resulting in higher market volatility.

The capacity of domestic investor to buy and hold government bonds was constrained by the deteriorating funding situation of banks, primarily due to money market fund liquidations and redemptions of negotiable certificates of deposit. The interbank ZAR market showed signs of strains, with liquidity shortages reflected in the ZAR-implied interest rates moving above interbank repo rates.

The FX swap market came under stress. Implied short-term ZAR rates, which normally remain within the SARB interest rate corridor, became extremely volatile and at times traded above the SARB lending facility rate. The elevated cross-currency basis is indicative of a ZAR liquidity surplus in the money market arising from SARB’s crisis operations. At the same time, there has been a ZAR liquidity shortage in the FX swap and forward market, following the SARB’s decision to neutralize the money market impact of converting international financial institution flows to ZAR through FX swaps.



What Was Done?

Initial central bank response was limited to conventional domestic liquidity injections and market support measures. The policy rate was cut, and additional liquidity was provided via open market operations. There were no spot FX interventions, term FX funding provisions, or any other unconventional monetary policy measure implemented.

The SARB intervened in the money market to incentivize domestic banks to purchase the government bonds being sold by non-residents. The measures included offering intraday, overnight, and supplementary repurchase operations, and term repurchase facilities. The interest rates on standing facilities were also adjusted, and the targeted weekly money market shortage was reduced from ZAR 56 billion to 45 billion by increasing the size of the main refinancing operations. With more liquidity and term funding, banks were able to continue lending and purchase government bonds. The asymmetric reduction of the standing facility rates strongly incentivized banks to search for alternative assets, specifically government bonds.

In response to deteriorating market conditions, the SARB announced on March 25, 2020, a government bond purchase program. A total ZAR 40 billion of bonds were purchased, representing less than 4 percent of

the SARB's total assets. The operations were concentrated in the second quarter of 2020, during which period their volume reached about 20 percent of the gross SAGB issuance, which underpinned demand. The SARB was not transparent about these operations and did not explain its strategy. Purchases were conducted bilaterally in a discreet manner in an attempt to preserve the element of surprise and mitigate risks of gaming and destabilizing speculation in anticipation of SARB government bond purchases. Nevertheless, market participants inferred that increased intraday volatility was the likely trigger for the purchases.

Were Interventions Effective?

Money market interventions proved effective to some extent. Demand for SARB term funding and short-term liquidity-providing operations had nearly disappeared by July 2020. While FX swap market volatility persisted, other measures of FX swap market functioning, such as bid-ask spreads, had improved by mid-2020. Term funding supported banks' capacity to purchase government bonds, with banks' holdings increasing from 17 percent of the total outstanding (end-2019) to 23 percent (end-2020).

The SARB government bond purchase program improved market functioning despite its limited size. The bid-ask spreads of benchmark bonds tightened gradually from their peak of 10 basis points in March 2020 to around 4–6 basis points by July 2020. Although these spreads are significantly wider than the pre-COVID levels, they are at levels consistent with other EMDE government bond markets. Yields declined markedly in 2020Q2, but the yield curve remained steeper than before, suggesting the SARB was not tempted to continue purchases with a yield level objective in mind. Furthermore, the SARB ensured that market functioning was understood as the primary objective of the program, rather than any other objective such as quantitative easing. As the SARB phased out its purchases in line with normalizing market functioning in 2020Q3, SAGB yields remained relatively stable, indicating the absence of significant speculative positioning for further bond purchases.

Exit Strategy and Communication

Liquidity operations were gradually unwound as money market conditions began to normalize. Specifically, the SARB's credit standing facility interest rates were restored to their standard levels in mid-August 2020: the credit standing facility rate was adjusted to the repo rate plus 100 basis points, and the deposit standing facility was adjusted to the repo rate less 100 basis points. The three-month term repo facility and intraday overnight supplementary repurchase operations were discontinued in December 2020 and February 2021, respectively, and the main Wednesday repurchase auction amount reverted to R56 billion in February 2021.

Bond market purchase activity subsided, but the market support program was never officially withdrawn. Although no significant purchases have been conducted since July 2020, the SARB continued to stand ready to intervene. Transparency was minimal during the interventions; however, monthly SAGB holdings were published with some lag. This asymmetry created challenges in managing expectations, as market participants attempted to interpret limited information, increasing the risk of misinterpretation of unexpected changes. To mitigate this risk, in the event of a bond redemption early in 2021, the SARB chose to roll over its SAGB holdings, thereby avoiding a drop in its bond holdings. While this action was inconsistent with the stated program objectives, it helped reinforce the SAGB's commitment to remain active in the market.

Key Lessons and Implications

The SARB's experience during the COVID-19 crisis was unique among emerging market peers for several reasons. While the ZAR exchange rate depreciated sharply, there were no persistent FX funding pressures evident in the FX swap market. Therefore, the SARB could focus its market support measures on addressing stresses in the domestic money market and bond markets. In addition, the concurrent sovereign credit rating downgrade amplified the shock, prompting an unprecedented intervention in the SAGB market. The SARB's sole objective was to restore market functioning, and in a way that minimized moral hazard. To achieve this, it limited transparency around its operations, an approach which led to other adverse effects. First, it constrained the market's ability to understand the precise actions of the central bank. Second, it complicated the exit strategy, making it nearly impossible, as the market was uncertain about the duration and conditions under which bond purchases would continue. In the absence of measurable expectations, the SARB was forced to keep the program in place permanently to avert potential market turbulence that could arise from an unexpected termination of the program.

Annex VII. Local Projections Model Estimates— Money Markets

Table 1 presents the estimated models for the impact of announcements of repo operations and adjustments (reductions or easing) in reserves requirements on the normalized spread of the interbank rate relative to the policy rate, traded interbank market volumes, and the Amihud ratio, which is the weekly volatility of absolute daily changes in the interbank rate relative to daily average traded volumes.

	Interbank rate – policy Rate	Standard deviation of Interbank rate – policy rate	Traded volumes	Amihud ratio
Lagged dependent (1)	0.903*** (0.033)	1.090*** (0.031)	0.484*** (0.023)	0.957*** (0.007)
Lagged dependent (2)		-0.196*** (0.032)	0.093*** (0.032)	0.587*** (0.138)
Lagged dependent (3)			0.033 (0.023)	-0.802*** (0.150)
Lagged dependent (4)			0.063*** (0.022)	0.103*** (0.031)
Lagged dependent (5)			-0.007 (0.050)	0.026 (0.044)
Lagged dependent (6)			0.044* (0.023)	-0.010*** (0.001)
Lagged dependent (7)			0.005 (0.022)	0.001 (0.003)
Lagged dependent (8)			0.064*** (0.022)	-0.000 (0.000)
Lagged dependent (9)			0.073*** (0.025)	
Term repo announced	0.013 (0.009)	-0.003 (0.005)	-10.083 (7.427)	-0.000 (0.000)
Reserve requirement announced	0.012 (0.036)	-0.001 (0.002)	10.615 (23.229)	-0.000 (0.000)
Other Easing in framework announced	-0.006 (0.007)	0.005 (0.003)	-0.820 (5.874)	0.000 (0.000)
FX intervention announced	0.043 (0.039)	-0.002 (0.004)	-18.389 (17.205)	0.000 (0.000)
FX funding support announced	-0.010 (0.013)	-0.002 (0.003)	2.870 (10.352)	-0.000** (0.000)

¹ Daily traded volumes are normalized by dividing daily volumes by average daily volumes over the previous year. The difference between the interbank and policy rate is measured as the absolute value and normalized by the average level over the preceding year. The standard deviation of the difference between the interbank rate and the policy rate is measured over a 10-day window. The Amihud ratio is calculated as the standard deviation of the difference between the interbank rate and the policy rate over a 10-day window, divided by the 10-day moving average of daily traded volumes. "MPR" denotes the level of the monetary policy rate, while ActionFL and Action PVVPP indicate announcements of funding for lending and private sector asset purchases.

Table 1. Money Market Local Projections Model Estimates (continued)

Government bond purchases announced	0.002 (0.016)	-0.009 (0.008)	5.001 (8.997)	0.000 (0.000)
actionFL	-0.001 (0.017)	-0.002 (0.003)	-10.381 (8.508)	-0.000 (0.000)
actionPRVPP	-0.051 (0.042)	0.012 (0.008)	10.581 (7.203)	0.000 (0.000)
mpr	-0.003 (0.002)	0.001** (0.000)	1.323 (1.118)	-0.000 (0.000)
VIX	-0.000 (0.000)	0.000** (0.000)	0.046 (0.077)	0.000* (0.000)
EURUSD_CIP	-0.001 (0.002)	0.000 (0.001)	-3.090 (3.028)	0.000 (0.000)
2.day_of_week	0.002 (0.002)	-0.001** (0.000)	-1.555** (0.678)	-0.000 (0.000)
3.day_of_week	0.003 (0.003)	0.001 (0.001)	-1.182 (1.345)	0.000 (0.000)
4.day_of_week	0.000 (0.001)	-0.000 (0.000)	-3.169 (2.254)	0.000* (0.000)
5.day_of_week	0.004** (0.002)	0.001** (0.001)	-0.873 (2.037)	0.000 (0.000)
2.month			0.605 (1.302)	-0.000 (0.000)
3.month			-1.666 (2.315)	-0.000 (0.000)
4.month			-0.831 (1.397)	0.000 (0.000)
5.month			-2.844 (1.972)	0.000 (0.000)
6.month			-1.182 (1.951)	0.000 (0.000)
7.month			-0.163 (2.064)	-0.000 (0.000)
8.month			-1.615 (2.589)	0.000 (0.000)
9.month			-2.358 (2.258)	0.000 (0.000)
10.month			-1.097 (2.081)	-0.000 (0.000)
11.month			-1.411 (2.038)	0.000 (0.000)
12.month			-2.035 (3.055)	0.000 (0.000)
Constant	0.006 (0.005)	-0.001 (0.001)	11.983** (5.148)	0.000 (0.000)
Observations	10,533	11,602	8,545	10,538
Number of countries included	24	24	23	23
R-squared	0.817	0.841	0.509	0.866

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff analysis.

Annex VIII. Local Projections Model Estimates— Government Bond Markets

Table 1 presents the models estimated for the impact of government bond purchase operations on government bond asset swap spreads, bid/offer spreads, daily traded volumes, and the Amihud ratio, which measures the weekly volatility of absolute daily changes in government bond rates relative to daily average volumes traded.

Table 1. Government Market Panel Regression Estimates for 20-days Ahead

	<i>Dependent variable:</i>			
	Bid/ask spread	Asset swap spread	Amihud ratio	Market turnover
Lagged dependent (1)	-0.48*** (-0.02)	-0.17*** (-0.02)	-0.67*** (-0.02)	-0.65*** (-0.02)
Lagged dependent (2)	-0.26** (-0.02)	-0.07*** (-0.02)	-0.43*** (-0.03)	-0.41*** (-0.03)
Lagged dependent (3)	-0.09*** (-0.02)	-0.06*** (-0.02)	-0.23*** (-0.02)	-0.20*** (-0.02)
Intervention announcement	-0.004 (-0.57)	-15.69*** (-3.87)	0.71 (-0.47)	0.19 (-0.17)
VIX	0.05*** (-0.01)	-0.04 (-0.07)	0.0003 (-0.01)	-0.01 (-0.004)
MOVE	0.01 (-0.01)	-0.02 (-0.04)	0.01*** (-0.004)	-0.003 (-0.002)
Federal Reserve intervention announcement	-0.09 (-0.49)	6.11* (-3.31)	0.03 (-0.38)	-0.18 (-0.21)
USCRD	0.02*** (-0.004)	0.11*** (-0.03)	0.003 (-0.003)	-0.0004 (-0.002)
Observations	2,627	2,627	1,751	1,751
R ²	0.21	0.04	0.33	0.31
Adjusted R ²	0.20	0.03	0.32	0.30

Note: * p<0.1; ** p<0.05; *** p<0.01.

Source: IMF staff analysis.

Notes: Amihud ratio is the standard deviation of the spread of the interbank rate to the policy rate divided by daily traded volumes. VIX is the first difference of the Chicago Board Option Exchange implied volatility index of S&P 500 futures. MOVE, the Merrill Lynch Option Volatility Estimate, is the first difference of the U.S. Treasury bond futures volatility index. USCRD, the U.S. credit spread is the first difference of the credit spread of investment grade corporate bonds over the 10-year U.S. Treasury yield.

Annex IX. Local Projections Model Estimates— FX Funding Markets

Table 1 presents the models estimated for the FX funding markets dataset, utilizing the global common factor and idiosyncratic factors for deviations from covered interest parity and bid-offer spreads.

The announcements covered encompass the initiation of FX swap or FX lending operations, in addition to announcements related to the expansion/enhancement of the Federal Reserve's swap line network.

Table 1. Panel Regression Estimates and Local Projection Impulse Response Functions

Dependent variable:

	Bid/ask spread	Bid/ask spread (common)	Bid/ask spread (unique)	CIP deviation	CIP deviation (common)	CIP deviation (unique)
Lagged dependent (1)	-0.50*** (-0.02)	-0.06** (-0.02)	-0.54*** (-0.02)	-0.12*** (-0.02)	-0.06** (-0.02)	-0.09*** (-0.02)
Lagged dependent (2)	-0.28*** (-0.03)	0.05* (-0.02)	-0.32*** (-0.03)	-0.06** (-0.02)	-0.30*** (-0.02)	-0.04* (-0.02)
Lagged dependent (3)	-0.16*** (-0.02)	0.01 (-0.02)	-0.19*** (-0.02)	-0.10*** (-0.02)	0.09*** (-0.02)	-0.14*** (-0.02)
VIX	0.01 (-0.01)	0.01*** (-0.003)	-0.01 (-0.01)	0.01 (-0.01)	-0.001 (-0.002)	0.01 (-0.01)
Federal Reserve swapline announcement	1.59** (-0.68)	0.78*** (-0.15)	0.51 (-0.65)	1.48*** (-0.36)	0.84*** (-0.11)	0.64* (-0.33)
Local intervention announcement	-0.2 (-1.06)	-0.87*** (-0.23)	0.64 (-1.02)	0.26 (-0.52)	-0.1 (-0.15)	0.24 (-0.48)
Observations	1,697	1,697	1,697	1,697	1,697	1,697
R ²	0.21	0.04	0.23	0.03	0.14	0.03
Adjusted R ²	0.2	0.03	0.22	0.02	0.13	0.02

Source: IMF staff analysis.

Note: CIP is the covered interest parity. VIX is the first difference of the Chicago Board Option Exchange implied volatility index of S&P 500 futures and *p<0.1; **p<0.05; ***p<0.01.

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