

INTERNATIONAL MONETARY FUND

GLOBAL FINANCIAL STABILITY REPORT

Shockwaves from the War in Ukraine
Test the Financial System's Resilience

2022
APR



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Editor's Note (April 22, 2022)

This online version of the GFSR has been updated to reflect the following changes to the version published online on April 13, 2022:

- Chapter 3, Figure 3.11, panel 1 subtitle on page 79: "(Billions of US dollars)" was corrected to "(Millions of US dollars)"

ASSUMPTIONS AND CONVENTIONS

The following conventions are used throughout the *Global Financial Stability Report* (GFSR):

- ... to indicate that data are not available or not applicable;
- to indicate that the figure is zero or less than half the final digit shown or that the item does not exist;
- between years or months (for example, 2021–22 or January–June) to indicate the years or months covered, including the beginning and ending years or months;
- / between years or months (for example, 2021/22) to indicate a fiscal or financial year.

“Billion” means a thousand million.

“Trillion” means a thousand billion.

“Basis points” refers to hundredths of 1 percentage point (for example, 25 basis points are equivalent to $\frac{1}{4}$ of 1 percentage point).

If no source is listed on tables and figures, data are based on IMF staff estimates or calculations.

Minor discrepancies between sums of constituent figures and totals shown reflect rounding.

As used in this report, the terms “country” and “economy” do not in all cases refer to a territorial entity that is a state as understood by international law and practice. As used here, the term also covers some territorial entities that are not states but for which statistical data are maintained on a separate and independent basis.

The boundaries, colors, denominations, and any other information shown on the maps do not imply, on the part of the International Monetary Fund, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

FURTHER INFORMATION

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PREFACE

The *Global Financial Stability Report* (GFSR) assesses key vulnerabilities the global financial system is exposed to. In normal times, the report seeks to play a role in preventing crises by highlighting policies that may mitigate systemic risks, thereby contributing to global financial stability and the sustained economic growth of the IMF's member countries.

The analysis in this report was coordinated by the Monetary and Capital Markets (MCM) Department under the general direction of Tobias Adrian, Director. The project was directed by Fabio Natalucci, Deputy Director; Ranjit Singh, Assistant Director; Nassira Abbas, Deputy Division Chief; Antonio Garcia Pascual, Deputy Division Chief; Evan Papageorgiou, Deputy Division Chief; Mahvash Qureshi, Division Chief; and Jérôme Vandenbussche, Deputy Division Chief. It benefited from comments and suggestions from the senior staff in the MCM Department.

Individual contributors to the report were Jose Abad, Sergei Antoshin, Parma Bains, Liumin Chen, Yingyuan Chen, Fabio Cortes, Reinout De Bock, Andrea Deghi, Mohamed Diaby, Dimitris Drakopoulos, Torsten Ehlers, Salih Fendoglu, Charlotte Gardes-Landolfini, Deepali Gautam, Rohit Goel, Sanjay Hazarika, Frank Hespeler, Henry Hoyle, Shoko Ikarashi, Tara Iyer, Phakawa Jeasakul, Esti Kemp, Oksana Khadarina, Sheheryar Malik, Fabiana Melo, Junghwan Mok, Kleopatra Nikolaou, Natalia Novikova, Thomas Piontek, Patrick Schneider, Nobuyasu Sugimoto, Hamid Reza Tabarraei, Tomohiro Tsuruga, Jeffrey David Williams, Hong Xiao, Yizhi Xu, Dmitry Yakovlev, Mustafa Yenice, Akihiko Yokoyama, Zhichao Yuan, and Xingmi Zheng. Javier Chang, Monica Devi, Olga Tamara Maria Lefebvre, and Srujana Sammeta were responsible for word processing.

Gemma Rose Diaz from the Communications Department led the editorial team and managed the report's production with editorial assistance from David Einhorn, Harold Medina (and team), Lucy Scott Morales, Nancy Morrison, Grauel Group, and TalentMEDIA Services.

This issue of the GFSR draws in part on a series of discussions with banks, securities firms, asset management companies, hedge funds, standard setters, financial consultants, pension funds, trade associations, central banks, national treasuries, and academic researchers.

This GFSR reflects information available as of April 7, 2022. The report benefited from comments and suggestions from staff in other IMF departments, as well as from Executive Directors following their discussions of the GFSR on April 11, 2022. However, the analysis and policy considerations are those of the contributing staff and should not be attributed to the IMF, its Executive Directors, or their national authorities.

FOREWORD

The backdrop of this *Global Financial Stability Report* is a challenging one. Rising risks to the inflation outlook and rapidly changing views about the likely pace of monetary policy tightening have been dominant themes affecting financial stability. Juxtaposed against financial stability risks is the Russian invasion of Ukraine, which will exert a material drag on the global recovery and pose significant uncertainties to the outlook. The balance of risks to growth has tilted more firmly to the downside as outlined in the April 2022 *World Economic Outlook*. These developments have occurred just as the world is slowly bringing the pandemic under control and as the global economy continues to recover from COVID-19.

The sharp rise in commodity prices—in concert with more prolonged supply disruptions—have exacerbated preexisting inflation pressures and led to a significant rise in inflation expectations. Central banks face heightened challenges in credibly bringing inflation to target while safeguarding economic recovery. They will have to navigate a delicate balancing act between removing accommodation at a pace that prevents an unmooring of inflation expectations while avoiding a disorderly tightening of financial conditions that could interact with financial vulnerabilities and weigh on growth.

Financial stability risks have risen along several dimensions and the resilience of the global financial system may be tested. A sudden repricing of risk from an intensification of the war may expose, and interact with, some of the vulnerabilities built up during the pandemic, and lead to a sharp decline in asset prices. Potential transmission channels of the war in Ukraine on global financial markets include inflation pressure from commodity price shocks, direct and indirect exposures of banks and nonbank financial intermediaries and firms, disruptions in commodity markets, counterparty risk exposures, poor market liquidity and funding strains, and cyberattacks affecting the resilience of financial market utilities and broader market functioning. While the financial system has

proven resilient to recent shocks, future shocks could be more harmful.

Emerging and frontier markets are facing tighter external financial conditions on the back of monetary policy normalization and heightened geopolitical uncertainty, which is increasing downside risks for portfolio flows. Emerging market sovereigns have become more reliant on domestic banks for funding, and bank holdings of domestic sovereign debt have surged to historic highs. Distress in emerging markets could trigger an adverse feedback loop between sovereigns and banks through multiple channels—the sovereign-bank nexus—potentially reducing bank soundness and lending to the economy. In China, the ongoing stress in the real estate sector and the increase in COVID cases has raised concerns about a growth slowdown, with potential feedback effects and possible spillovers to other emerging markets.

Policymakers will need to confront these challenges by taking decisive actions to address financial vulnerabilities and rein in rising inflation. To manage the delicate balance between containing inflation and supporting the recovery from the pandemic, interest rates might have to rise beyond what is currently priced in markets to get inflation back to target in a timely manner. For many countries, this may entail pushing interest rates well above their neutral level.

While taking relevant steps to address energy security concerns, policymakers should intensify their efforts to implement the COP26 roadmap. Although notable progress has been made to strengthen the climate information architecture in terms of disclosure standards and bridging data gaps, focused policies aimed at scaling up private finance in the transition to a greener economy remain a major imperative.

The war in Ukraine has also brought to the fore a number of medium-term structural issues policymakers will need to confront in coming years. The geopolitics of energy security may put climate

transition at risk. Capital markets might become more fragmented, with possible implications for the role of the US dollar. And the fragmentation of payment systems could be associated with the rise of central bank digital currency blocs. In addition, more widespread use of crypto assets in emerging

markets could undermine domestic policy objectives. Multilateral cooperation will remain key to overcome these medium-term challenges.

Tobias Adrian
Financial Counsellor

EXECUTIVE SUMMARY

Global financial conditions have tightened notably and downside risks to the economic outlook have increased as a result of the war in Ukraine (Figure 1). The tightening has been particularly pronounced in eastern Europe and Middle East countries with close ties to Russia, reflecting lower equity valuations and higher funding costs. This has occurred just as most of the world was slowly bringing the pandemic under control and the global economy was recovering from COVID-19.

Financial stability risks have risen on several fronts, even though so far, no global systemic event affecting financial institutions or markets has materialized. A sudden repricing of risk resulting from an intensification of the war and associated escalation of sanctions may expose, and interact with, some of the vulnerabilities built up during the pandemic, leading to a sharp decline in asset prices.

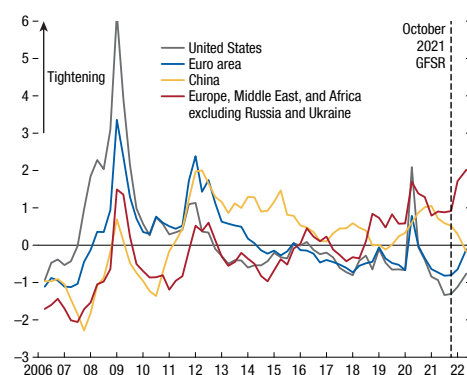
With the sharp rise in commodity prices anticipated to add to preexisting inflation pressure, central banks are faced with a challenging trade-off between fighting record-high inflation and safeguarding the post-pandemic recovery at a time of heightened uncertainty about prospects for the global economy (Figure 2). Bringing inflation back down to target and preventing an unmooring of inflation expectations require a delicate act in removing accommodation while preventing a disorderly tightening of financial conditions that could interact with financial vulnerabilities and weigh on growth. Incoming inflation data suggest that more decisive tightening of monetary policy is necessary in many countries.

After rising early in the year on concerns about the inflation outlook, advanced economy nominal bond yields have increased further since the invasion, amid heightened volatility of rates (Figure 3). Inflation break-evens (a market-implied proxy for future inflation) have risen significantly on the back of sharply higher commodity prices.

Repercussions of the Russian invasion of Ukraine and ensuing sanctions continue to reverberate globally and will test the resilience of the financial system through various potential amplification channels, including direct and indirect exposures of banks and nonbanks; market disruptions in commodity markets and increased counterparty risk; poor market liquidity and funding strains; acceleration of cryptoization in emerging markets; and possible cyber-related events.

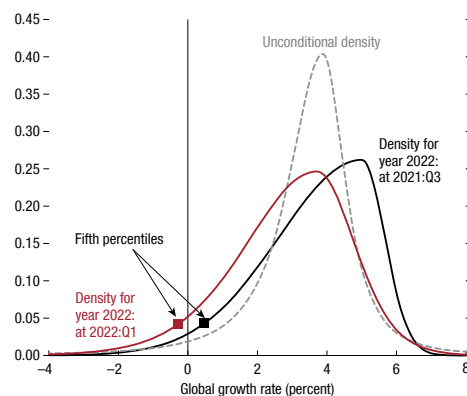
The war has already had an impact on financial intermediaries, nonfinancial firms, and markets directly or indirectly exposed to Russia and Ukraine. Europe bears a higher risk than other regions due to its proximity, reliance on Russia for energy

Figure 1. Financial Conditions in Selected Regions
(Standard deviations from the mean)



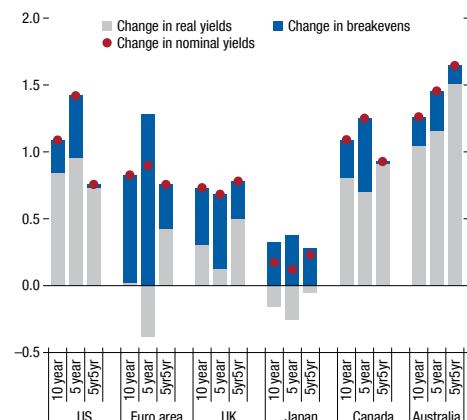
Source: IMF staff calculations.
Note: GFSR = Global Financial Stability Report.

Figure 2. Near-Term Growth Forecast Densities
(Probability density)



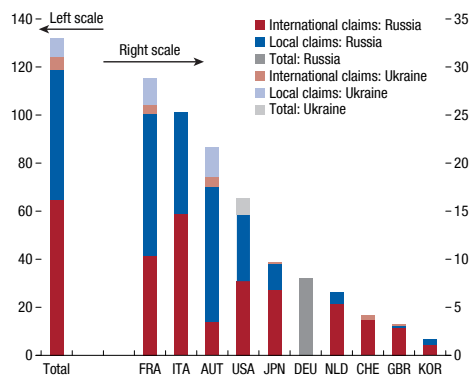
Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Figure 3. Year-to-Date Change in Yields
(Percentage points)



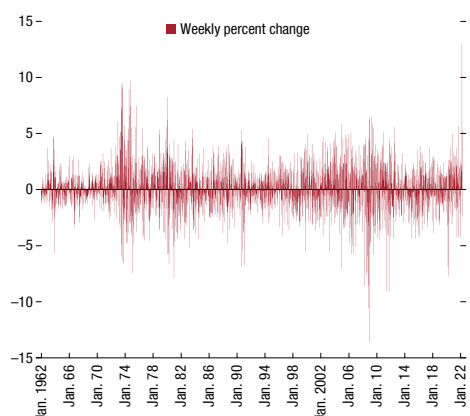
Sources: Bloomberg Finance L.P.; and IMF staff calculations.
Note: 5yr5yr (5-year, 5-year forward) corresponds to a five-year period that begins five years from the current date.

Figure 4. Foreign Banks' Gross Claims on Russia and Ukraine
(Billions of US dollars)



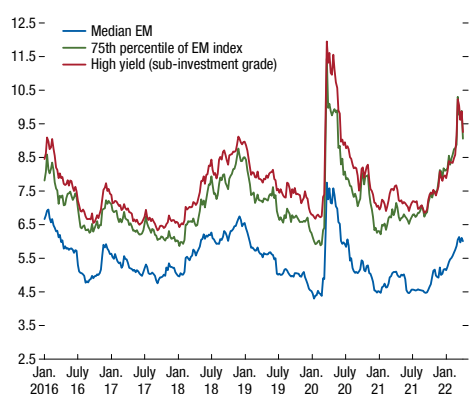
Sources: Bank for International Settlements Consolidated Banking Statistics; and IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes.

Figure 5. Commodity Price Changes, 1962–2022
(Percent)



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Figure 6. Emerging Market Hard Currency Yields
(Percent)



Sources: Bloomberg Finance L.P.; and IMF staff estimates.
Note: EM = emerging market; HY = high-yield. Yields based on JPMorgan Emerging Market Bond Index.

needs, and the non-negligible exposure of some banks and other financial institutions to Russian financial assets and markets.

Banks' direct exposures to Russia are relatively small except for some non-systemic European banks (Figure 4). Banks' indirect exposures are more difficult to identify and assess because they are less well known (especially the extent of interconnectedness) as it is difficult to quantify them in the absence of detailed and consistent disclosures by country or by specific activity types. The risk is that indirect exposures could be meaningful and surprise investors once revealed, leading to a sharp rise in counterparty risk and risk premia. Foreign non-bank financial intermediaries (NBFIs) have sizable investments in Russian assets, with US and European investment funds accounting for most of the exposures. As a share of total assets, however, their exposure to Russia is small.

Dedicated emerging market funds have maintained a cautious stance on their exposures to Russian debt since the Crimea occupation in 2014, reducing their share of Russian debt from more than 10 percent before 2014 to just over 4 percent in 2022. Funds benchmarked to global indices have had a much smaller exposure to Russia, with an average 0.2 percent of their assets invested in Russian debt in 2022.

Severe disruptions in commodity markets and supply chains across the globe have caused extreme volatility in commodity prices, amplified by pressures in commodity trade finance and derivatives markets (Figure 5). Dealer banks play a crucial role and have significant exposures in these markets, including by providing liquidity and credit to a small group of large energy trading firms that operate globally, are largely unregulated, and are mostly privately owned. Pressures in commodity markets, often magnified by poor liquidity, have led to lower risk appetite and rising counterparty risk concerns, with implications for funding conditions.

Emerging and frontier markets are facing tighter financial conditions and higher risks of capital outflows. Since the war in Ukraine began, emerging market (EM) hard currency yields have increased at a rapid pace, akin to earlier episodes of emerging market stress, before retracing some in mid-March (Figure 6). The number of issuers trading at distressed levels has surged to nearly 25 percent of issuers (Figure 7), surpassing pandemic-peak levels. The deterioration in spreads, combined with the increase in US yields, has pushed financing costs well above their pre-pandemic levels for many borrowers. Markets remain open for issuance at those higher levels of funding costs. Flows in local currency bonds and equities have come under pressure, experiencing the largest weekly redemptions since March 2020. Tighter external financial conditions on the back of US monetary policy normalization and heightened geopolitical uncertainty are likely to increase the downside risks for portfolio flows (Figure 8).

In China, the recent equity sell-off, particularly in the tech sector, and the increase in COVID-19 cases have raised concerns about a growth slowdown, with possible spillovers to emerging markets. Ongoing stress in the battered real estate sector has increased financial stability risks and added to growth pressures. Extraordinary financial support measures may be necessary to ease pandemic-driven balance sheet pressures but would add further to medium-term debt vulnerabilities.

The interlinkages between emerging market sovereigns and domestic banks have intensified over the past two years as additional government financing needs to cushion the impact of the pandemic have been mostly met by banks (see Chapter 2). As a result, bank holdings of domestic sovereign debt surged to historic highs in 2021 (Figure 9). Distress in emerging markets could trigger an adverse feedback loop between sovereigns and banks through multiple channels—the so-called sovereign-bank nexus—potentially reducing bank soundness and lending to the economy.

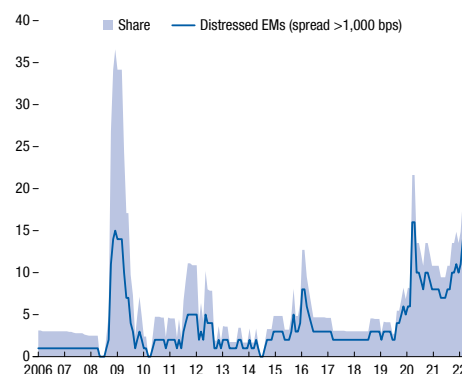
The war in Ukraine has brought to the fore a number of medium-term structural issues policymakers will need to confront in coming years, including the possibility that the geopolitics of energy security may put climate transition at risk; the risk of fragmentation of capital markets and possible implications for the role of the US dollar; the risk of fragmentation in payment systems and the creation of blocs of central bank digital currencies; more widespread use of crypto assets in emerging markets; and more complex and bespoke asset allocations in an effort to preempt the possible imposition of sanctions.

The war has made evident the urgency to cut dependency on carbon-intensive energy and to accelerate the transition to renewables. However, in the face of growing concerns about energy security and access to energy sources (Figure 10), the energy transition strategy may face setbacks for some time. The current energy crisis may alter the speed of phasing out fossil fuel subsidies in emerging market and developing economies, while rising inflation pressure may also lead authorities to resort to subsidies or other forms of fiscal support to households or firms.

Crypto asset trading volumes against some emerging market currencies have spiked following the introduction of sanctions against Russia and the use of capital restrictions in Russia and Ukraine. This is occurring against a longer-term increase in such cross-border transactions, bringing to the fore the challenges of applying capital flow measures and sanctions.

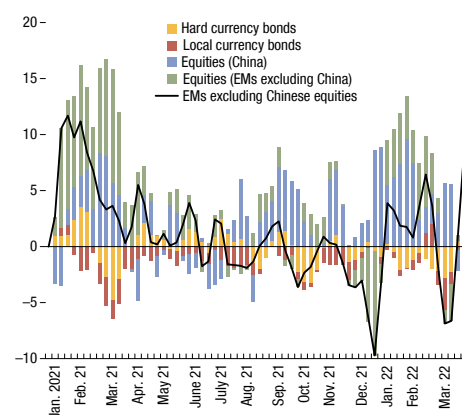
While technological innovation in financial activities (fintech) can support inclusive growth by strengthening competition, financial development, and inclusion (Chapter 3), the rapid growth of risky business segments can be a cause of concern for financial stability when fintech firms (fintechs) are subject to less stringent regulation (Figure 11).

Figure 7. Distressed Sovereign Hard Currency Issuers
(Number of sovereigns with spreads above 1,000 basis points; share of total)



Sources: JPMorgan Chase & Co.; and IMF staff calculations.
Note: bps = basis points; EMs = emerging markets.

Figure 8. Fund Flows to Emerging Markets
(Billions of US dollars, two-week moving sum)

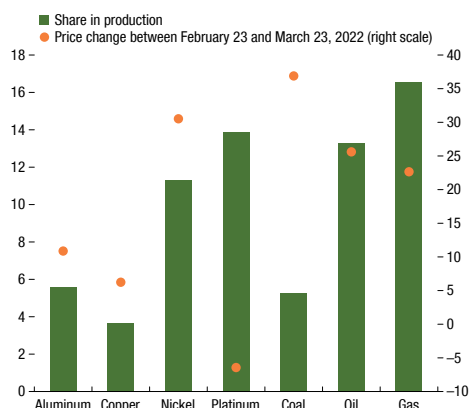


Sources: EPFR; and IMF staff calculations.
Note: EMs = emerging markets.

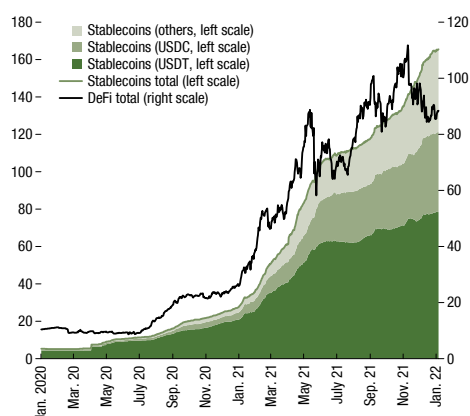
Figure 9. Bank-Sovereign Debt Exposure, 2005–21
(Percent)



Sources: IMF, Monetary and Financial Statistics; and IMF staff calculations.
Note: See Figure 2.1, panel 2 of Chapter 2 for more information. AEs = advanced economies; EMs = emerging markets.

Figure 10. Russia's Share in Global Production
(Percent)

Sources: US Geological Survey, National Minerals Information Center; and IMF staff calculations.

Figure 11. Value of DeFi Assets and Stablecoins
(Billions of US dollars)

Sources: CoinGecko; DeFi Pulse; and IMF staff calculations.
Note: DeFi = decentralized finance; USDC = USD Coin; USDT = USD Tether.

Policy Recommendations

Central banks should act decisively to prevent inflation pressure from becoming entrenched and avoid an unmooring of inflation expectations. To avoid unnecessary volatility in financial markets, it is crucial that central banks in advanced economies provide clear guidance about the normalization process while remaining data dependent.

Emerging markets remain vulnerable to a disorderly tightening of global financial conditions. Many central banks have already significantly tightened policy. Further rate increases, or policy normalization with respect to other measures taken during the pandemic (such as asset purchases), should continue as warranted according to the country-specific inflation and economic outlook to anchor inflation expectations and preserve policy credibility.

Policymakers should tighten selected macroprudential tools to tackle pockets of elevated vulnerabilities while avoiding a disorderly tightening of financial conditions. Striking a balance between containing the buildup of vulnerabilities and avoiding procyclicality appears important given uncertainties about the economic outlook, the ongoing monetary policy normalization process, and limits on fiscal space in the aftermath of the pandemic.

While taking steps to address energy security concerns, policymakers should intensify their efforts to implement the 2021 United Nations Climate Change Conference (COP26) road map to achieve net-zero targets. They should take measures to increase the availability and lower the cost of fossil fuel alternatives and renewables while improving energy efficiency; scale up private finance in the transition to a greener economy; and continue to strengthen the climate finance information architecture.

Policymakers should develop comprehensive global standards for crypto assets along the activity and risk spectrum. A more robust oversight of fintech firms and decentralized finance (DeFi) platforms is needed to take advantage of their benefits while mitigating their risks. To preserve the effectiveness of capital flow management measures in an environment of growing usage of crypto assets, policymakers need to pursue a multifaceted policy strategy. Recent measures taken in markets and exchanges in response to elevated volatility in commodity prices highlight the need for regulators to examine the broader implications, including exchange governance mechanisms, resiliency of trading systems, concentration of risk, margin setting, and trading transparency in exchange and over-the-counter markets.

IMF EXECUTIVE BOARD DISCUSSION OF THE OUTLOOK, APRIL 2022

The following remarks were made by the Chair at the conclusion of the Executive Board's discussion of the Fiscal Monitor, Global Financial Stability Report, and World Economic Outlook on April 11, 2022.

Executive Directors broadly agreed with staff's assessment of the global economic outlook, risks, and policy priorities. They noted that the war in Ukraine has led to a costly humanitarian crisis, with economic and financial repercussions and spillovers—through commodity markets, confidence, trade, and financial channels—that have prompted a downgrade to the global economic outlook and increased inflationary pressures at a time when the global economy has not yet recovered from the COVID-19 crisis. Directors concurred that the sharp increase in uncertainty could make economic projections especially volatile. They agreed that emerging risks—from an intensification of the war, further sanctions on Russia, fragmentation in financial and trade markets, and a sharper-than-expected slowdown in China due to COVID-19 outbreaks—on top of the continued risk of new, more virulent COVID-19 strains have further tilted the balance of risks to the downside. Moreover, Directors noted that the war in Ukraine has increased the likelihood of food shortages and wider social tensions given higher food and energy prices, which would further adversely impact the outlook.

Against this backdrop, Directors agreed that policy priorities differ across countries, reflecting local circumstances and differences in trade and financial exposures. Directors emphasized that the layering of strains—slowing economic growth, persistent and rising inflation pressures, increased food and energy insecurity, continued supply chain disruptions, and COVID-19 flare-ups—further complicates national policy choices, particularly for countries where policy space shrank after the necessary response to the COVID-19 pandemic. At the global level, Directors stressed that multilateral cooperation and dialogue remain essential to defuse geopolitical tensions and avoid fragmentation, end the pandemic, and respond

to the myriad challenges facing our interconnected world, particularly climate change.

Directors concurred that, in many countries, fiscal policy is operating in a highly uncertain environment of elevated inflation, slowdown in growth, high debt, and tightening borrowing conditions. While acknowledging that fiscal policy has a role to play in moments of large adverse shocks, Directors considered that, particularly for countries with tighter budget constraints, fiscal support should focus on priority areas and target the most vulnerable. They emphasized that, in countries where economic growth is strong and where inflation is elevated, fiscal policy should phase out pandemic-related exceptional support, moving toward normalization. Directors acknowledged that many emerging markets and low-income countries face difficult choices given limited fiscal space and higher demands on governments due to energy disruptions and the pressing need to ensure food security. In this context, they underscored that a sound and credible medium-term fiscal framework, including spending prioritization and measures to raise revenues, can help manage urgent needs while ensuring debt sustainability. Directors stressed that short-term measures to mitigate high food and energy prices should not undermine actions to ensure greater resilience through investment in health, food, and cleaner energy sources.

Directors concurred that monetary authorities should act decisively to prevent inflationary pressures from becoming entrenched and avoid a de-anchoring of inflation expectations. They noted that central banks in many advanced and emerging market economies need to continue tightening the monetary policy stance to bring inflation credibly back to target and preserve hard-built policy credibility. Directors stressed that transparent, data-driven, and clearly communicated monetary policy is critical to avoid financial instability. They considered that, should global financial

conditions tighten suddenly, emerging and developing economies could face capital outflows and should be ready to use all available tools, including foreign exchange interventions and capital flow management measures, when needed and in line with the Fund's Institutional View on the Liberalization and Management of Capital Flows and without substituting for exchange rate flexibility and warranted macroeconomic adjustments.

Directors agreed that the war in Ukraine will test the resiliency of the financial system. They noted that, although no systemic event has materialized so far, financial stability risks have risen along many dimensions while global financial conditions have tightened significantly. Directors concurred that, in those emerging markets where the sovereign-bank nexus could pose vulnerabilities, it should be closely monitored. They also noted risks of fragmentation of capital markets and payment systems, the creation of blocks of central bank digital currencies, a more widespread use of crypto assets, and more frequent cyberattacks. Directors recommended tightening selected macroprudential tools to tackle pockets of elevated vulnerabilities while avoiding procyclicality and a disorderly tightening of financial conditions. They also called for comprehensive global standards and a multifaceted strategy for crypto assets and for a more robust oversight of fintech firms and decentralized finance platforms.

Directors agreed that strong multilateral cooperation is essential to respond to existing and unfolding humanitarian crises, safeguard global liquidity,

manage debt distress, ensure food security, mitigate and adapt to climate change, and end the pandemic. Noting that many countries are coping with higher volatility, increased spending from the pandemic and humanitarian crises, and tightening financial conditions, Directors called on the Fund and other multilateral institutions to stand ready to provide financial support. At the same time, they noted that prompt and orderly debt restructuring, particularly by improving the G20 Common Framework, will be necessary in cases where liquidity support is insufficient. Directors noted that increasingly dire climate change developments heighten the urgency for tangibly advancing the green economic transformation. They stressed the importance of intensifying efforts to implement the COP26 roadmap together with appropriate measures to address energy security concerns. Directors considered that international cooperation in corporate taxation and carbon pricing could also help mobilize resources to promote the necessary investments and reduce inequality. As the pandemic persists, Directors underscored that prompt, equitable, and wider access to vaccinations, testing, and treatments remains a key priority. They also reiterated that measures to address the scars from the pandemic remain crucial to boost long-term prospects and create a more resilient and inclusive global economy. Above all, Directors called for a peaceful resolution of the war in Ukraine, an end to the resulting humanitarian crisis, and a return to the rules-based international order that helped lift millions out of poverty over the past decades.

THE FINANCIAL STABILITY IMPLICATIONS OF THE WAR IN UKRAINE

Chapter 1 at a Glance

- Global financial conditions have tightened notably and downside risks to the economic outlook have increased as a result of the Russian invasion of Ukraine. This has occurred in the context of the pandemic, which was slowly being brought under control, and the consequent recovery of the global economy from COVID-19.
- Financial stability risks have risen along many dimensions, although no global systemic event affecting financial institutions or markets has materialized so far.
- The sharp rise in commodity prices, which has exacerbated preexisting inflation pressure, poses challenging trade-offs for central banks.
- Repercussions of the war continue to reverberate globally and will test the resiliency of the financial system through various channels, including direct and indirect exposures of banks, nonbank financial intermediaries, and firms; market disruptions (including in commodity markets) and increased counterparty risk; acceleration of cryptoization in emerging markets; and possible cyber-related events.
- Emerging and frontier markets are facing tighter financial conditions and a higher probability of portfolio outflows (forecast at 30 percent now, up from 20 percent in the October 2021 *Global Financial Stability Report* [GFSR]).
- In China, financial vulnerabilities remain elevated amid ongoing stress in the property development sector and new COVID-19 outbreaks.
- In coming years, policymakers will need to confront a number of structural issues brought to the fore by the war in Ukraine and the associated sanctions against Russia, including the trade-off between energy security and climate transition, market fragmentation risks, and the role of the US dollar in asset allocation.
- Energy and food security concerns are acute and may put climate transition efforts at risk.
- Policymakers need to take decisive actions to rein in rising inflation and address financial vulnerabilities while avoiding a disorderly tightening of financial conditions that would jeopardize the post-pandemic economic recovery. Some businesses and households may need short-term fiscal support to navigate the consequences of the war.
- The surge in volatility and dislocations in commodity markets underscores the importance of ensuring the adequacy of disclosures and standards of transparency to counterparties, especially major financial institutions. This is essential to support comprehensive risk management and supervisory oversight.

The War in Ukraine Raises Immediate Financial Stability Risks and Questions about the Longer-Term Impact on Markets

Early in the year, financial markets were squarely focused on rising risks to the inflation outlook and implications for the global economy, especially given concerns about a possible slowdown in China. Investors were worried that central banks in advanced economies would have to normalize policy more aggressively than anticipated only a few months earlier,

causing a sharp tightening in financial conditions, especially in emerging markets. The war in Ukraine, while at this point not a global systemic event from a financial standpoint, is nonetheless anticipated to have a material impact on the economy amid heightened uncertainty about the outlook. In addition, the sharp rise in commodity prices further complicates the challenge faced by central banks in credibly bringing down inflation to target while safeguarding the post-pandemic recovery.

The repercussions of the Russian invasion of Ukraine in terms of economic damage will be greater for the war region and Europe. In particular, official sanctions¹ and further escalations thereof, multiple companies voluntarily severing ties with Russia, together with steps taken by several countries to wean off Russian energy imports, will cause substantial damage to the Russian economy. But the war is also expected to have significant implications for the global economy (see the April 2022 *World Economic Outlook* [WEO]) and for global financial markets beyond immediate financial stability risks. The severity of the disruptions in commodity markets and to global supply chains will weigh heavily on the outlook for inflation, the global economy, and possibly macro-financial stability. In addition, record high food prices could have implications for social unrest in some emerging and frontier markets.²

War is a risk that is difficult to insure against or hedge, so it is only natural that investors precipitously pull back from risk taking, causing volatility and correlations across asset classes to rise. Eventually, however, asset prices tentatively stabilized around a new normal as market participants assess the evolution of the war, geopolitical implications, and prospects for different asset classes and the economy.

The information content and signal that can be extracted from price moves of Russian and Ukrainian assets are severely limited by the sanctions and lack of liquidity in these markets. That said, such assets have experienced the largest price declines, with dollar-denominated sovereign bonds pricing a very high probability of default and a low rate of recovery (Figure 1.1, panel 1). The Russian ruble has fallen to all-time low levels against the US dollar, before recovering a substantial portion of the earlier declines.

¹Several advanced economies, including the United States, members of the European Union, Japan, and the United Kingdom, have imposed an unprecedented range of sanctions on Russia. These have prohibited financial institutions from engaging in any transaction involving the Central Bank of Russia, thus hindering its ability to access a substantial portion of its foreign reserves. Other sanctions have effectively banned all major Russian banks not related to the energy sector from doing business in the United States, the European Union, the United Kingdom, and Japan and have frozen their assets, while some large banks have also been banned from the SWIFT system. In addition, some entities and individuals have faced sanctions, and trade restrictions have been put in place on a variety of goods. Finally, some jurisdictions have announced bans on energy imports from Russia or plans to reduce their dependence on Russian energy.

²The United Nations food price index has already surpassed the levels seen in 2011, when social unrest was triggered in the Middle East and North Africa region.

The Ukrainian hryvnia exchange rate has been fixed as of February 24 (Figure 1.1, panel 2). Stock trading on the Moscow Exchange was halted on February 25 and reopened only on March 24 with substantial restrictions on trading (Figure 1.1, panel 3).

Among huge uncertainties and shifting prospects on the ground, investors have focused on severe disruptions in commodity markets as a crucial transmission channel and amplifier of the crisis. Disruptions could intensify in the event of a further escalation of the sanctions that could include an explicit ban of energy imports from Russia by Europe. Energy and food prices have risen sharply, and volatility has jumped (Figure 1.2, panels 1 and 2).

The rise in agricultural prices has important spillover effects for developing economies and emerging markets—especially in eastern Europe, the Caucasus, the Middle East, and North Africa—that are close trading partners of Russia and Ukraine. Metals, another Russian commodity export, is also affected, which has strong implications for global supply chains, including the renewable energy industry (Figure 1.2, panel 3; see also Box 1.1 for recent developments on nickel trading and the WEO Special Feature on commodities). Supply shortages are expected to persist, as seen in the very high relative price of short-term contracts over longer-term ones (Figure 1.2, panel 4).

After an initial deterioration of risk appetite following the Russian invasion of Ukraine, investors have become more optimistic about the outlook for risk assets since mid-March, with global equities recouping most of the earlier losses. Sectors already adversely affected by the pandemic—the airline and hospitality sectors—have seen large declines in stock prices (Figure 1.3, panel 1, upper segment). Other energy-intensive and energy-dependent sectors, such as automobiles, consumer durables, and industrials, have been hit by surging energy and metal prices, exacerbating COVID-19–related supply chain challenges. The food industry has come under pressure from the sharp rise in energy and agricultural commodity prices. Finally, Russia and Ukraine produce some critical inputs—gases and precious metals—for the information technology sector, particularly semiconductors, adding to supply chain challenges.³ As a result, there are growing concerns about further chip shortages and the associated impact on supply chains, delaying the resolution of pandemic-related issues and further inflating prices.

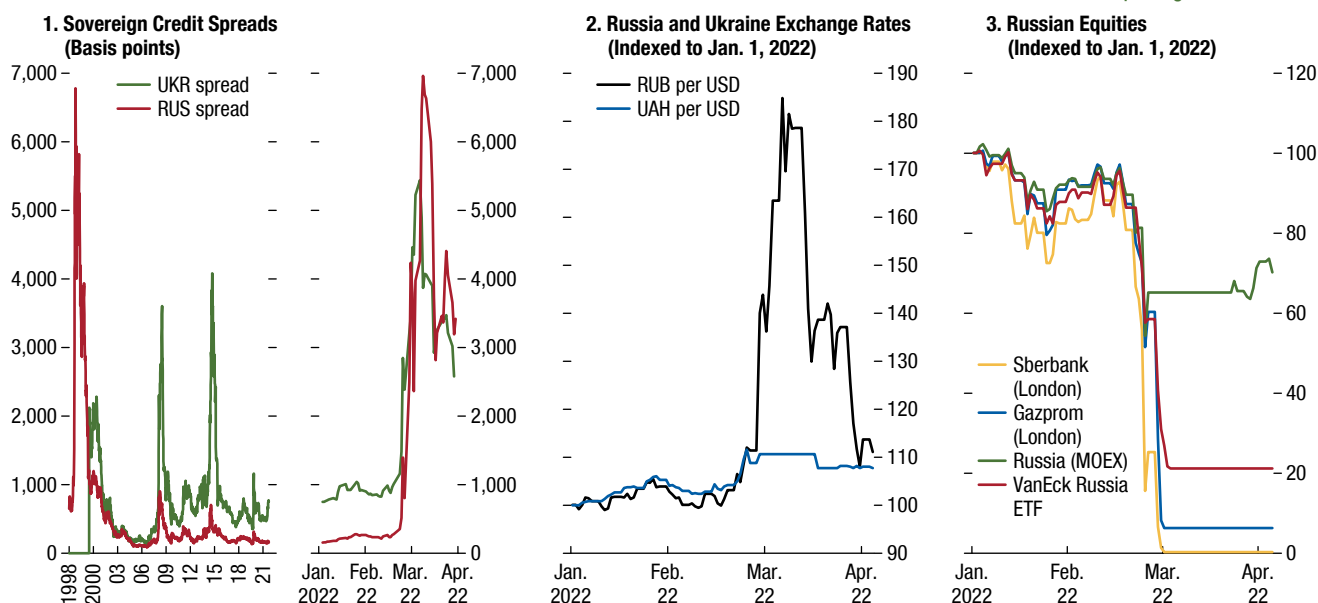
³See Chris Nuttall, “Ukraine War Is Chip Industry’s Kryptonite,” *Financial Times* (March 4, 2022).

Figure 1.1. Russian and Ukrainian Assets Have Come under Heavy Pressure Following the War in Ukraine

Russian and Ukrainian bonds are pricing a high probability of default amid poor liquidity for credit instruments.

The ruble hit record lows before retracing most of its losses.

Russian equities listed abroad collapsed, and the domestic market was closed for a month before reopening in late March.



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Note: The Ukrainian hryvnia exchange rate has been effectively fixed since February 24, 2022, with only limited trading in parallel markets. The Moscow Stock Exchange (MOEX) was closed from February 28–March 24. In panel 1, UKR refers to the United Kingdom–Russia spread; RUS spread refers to the Russia–United States spread. ETF = exchange-traded fund; RUB = Russian ruble; UAH = Ukrainian hryvnia.

Across regions, equity prices have been less affected in the United States and advanced Asia, as these economies are seen as relatively more shielded from the direct impact of the war and supported by the strong incoming economic data. In Europe, by contrast, investors appear to be more concerned about possible risks to the economic and inflation outlook given their geographical proximity to the war, relatively larger exposures, and energy dependency on Russia. Equity prices have fallen in emerging markets, in sync with rising external financing costs. The impact has been particularly pronounced for economies in central and eastern Europe. Chinese equities' notable underperformance in this period reflected rising geopolitical risks but also domestic factors like growth concerns amid COVID-related lockdowns and regulatory uncertainty in the tech industry.

Global corporate bond spreads have widened some, surpassing pre-pandemic levels across major sectors and most high-yield segments (Figure 1.3, panel 2). The increase has been more evident for the lowest-rated firms, pointing to concerns about

potential future defaults. In emerging markets, investors appear to be differentiating across countries, with those with closer economic ties to Russia through trade and remittances (Caucasus and Central Asia) and more risk-sensitive frontier market economies hit the hardest (Figure 1.3, panel 3). Currencies of Latin American countries and commodity exporters have outperformed relative to eastern European countries and oil importers in Asia (Figure 1.3, panel 4).

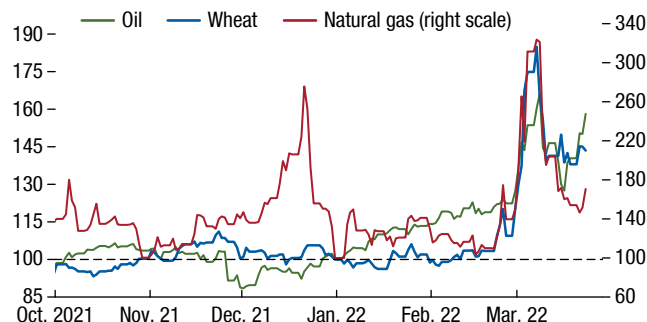
Volatility has risen sharply in both equity and interest rate markets following the Russian invasion of Ukraine, reflecting heightened uncertainty on the economic and policy outlook (Figure 1.4, panels 1 and 2). In equities, market-implied volatility has declined sharply recently, in some cases to levels below those that prevailed before the war, and is anticipated to remain around these levels through the end of 2022. In interest rates, market-implied volatility has remained elevated, reflecting uncertainties about the policy normalization process in advanced economies.

On balance, financial conditions in advanced economies have tightened notably this year, reflecting the

Figure 1.2. Impact of the War in Ukraine on Commodities

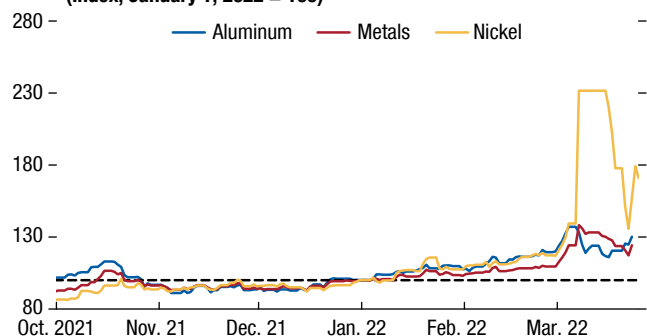
Several commodity prices have risen dramatically on fears of supply disruptions ...

1. Energy and Agricultural Commodity Prices
(Index, January 1, 2022 = 100)



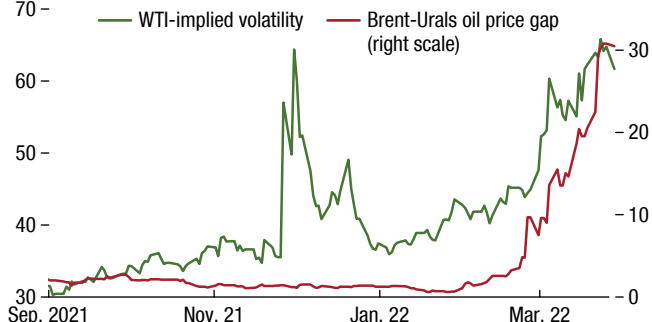
Industrial metals prices have surged amid risks to supply chains and trading disruptions on exchanges.

3. Metals Prices
(Index, January 1, 2022 = 100)



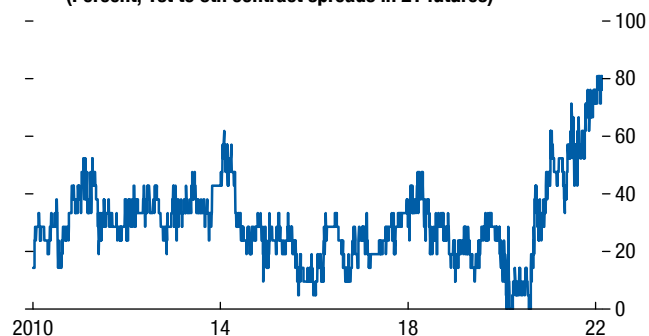
... and volatility in financial markets has spiked.

2. Oil Implied Volatility and Brent-Urals Price Spread
(Percent; US dollars per barrel)



Supply shortages are expected to persist in the short term for multiple commodities.

4. Share of Commodities in Backwardation
(Percent; 1st to 6th contract spreads in 21 futures)



Sources: Bloomberg Finance L.P.; and IMF staff calculations. Panel 3 uses three-month futures from the London Metals Exchange and Bloomberg Metals Index. Note: In panel 2, the volatility is three months annualized. In panel 4, backwardation occurs when the first contract price is higher than the prices of later contracts. WTI = West Texas Intermediate crude oil futures.

decline in corporate valuations, higher government bond yields, and continued expectations of monetary policy normalization. However, relative to historical levels, financial conditions remain easy or roughly neutral (Figure 1.5, panel 1). The sudden and significant increase in external borrowing costs and rising local currency rates have weighed heavily on financial conditions in eastern Europe and the Middle East with close ties to Russia (Figure 1.5, panel 2). Conditions have also tightened for many other emerging market economies, reflecting higher interest rates to combat inflation, lower equity valuations, and higher external borrowing costs. By contrast, conditions have eased in China, as policymakers have provided additional policy support to offset an economic slowdown, partly stemming from continued strains among property developers.

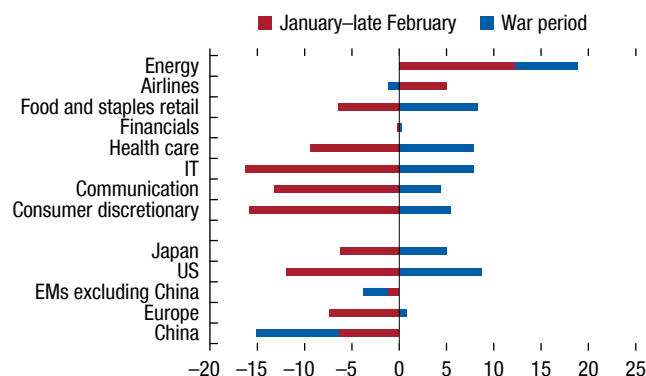
The Russian invasion of Ukraine is anticipated to have a material impact on the post-pandemic global economic recovery. Global economic growth for 2022 has been marked down to 3.6 percent, 0.8 percentage point lower than projected in the January 2022 WEO Update (see the April 2022 WEO). Amid heightened uncertainty, the balance of risks to growth this year remains skewed to the downside, as demonstrated via the growth-at-risk framework (Figure 1.6, panel 1).⁴ Moreover, the probability of growth falling below zero in 2022 is estimated at about 8 percent, with downside risks now at elevated levels compared with historical norms (Figure 1.6, panel 2).

⁴See Chapter 3 of the October 2017 GFSR for details of the Growth-at-Risk model.

Figure 1.3. Impact of the War in Ukraine on Financial Assets

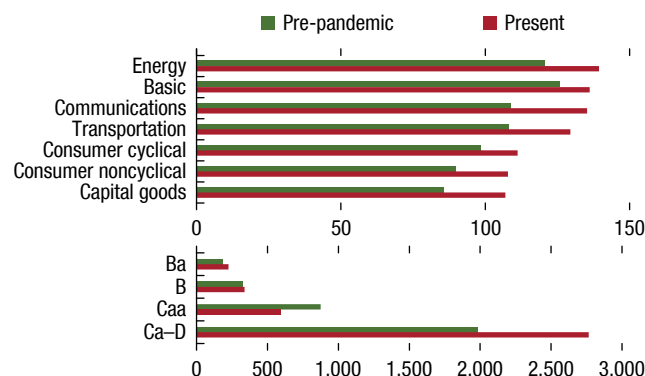
Equities have sold off, on net, in emerging markets and sectors affected by commodity prices and supply chain disruptions concerns ...

1. Global Equity Price Changes in 2022 (Percent)



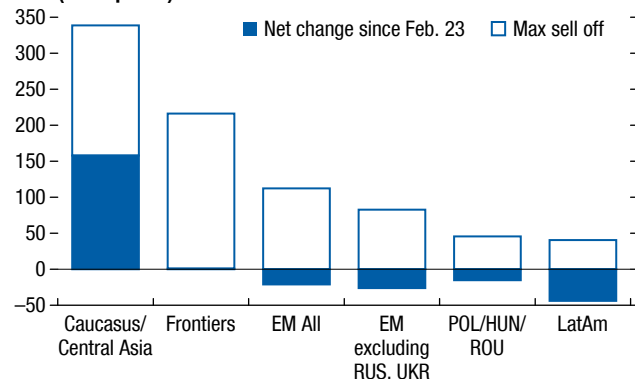
... and credit spreads have widened the most in low-rated firms.

2. Credit Spread Levels by Sector and Credit Rating (Basis points)



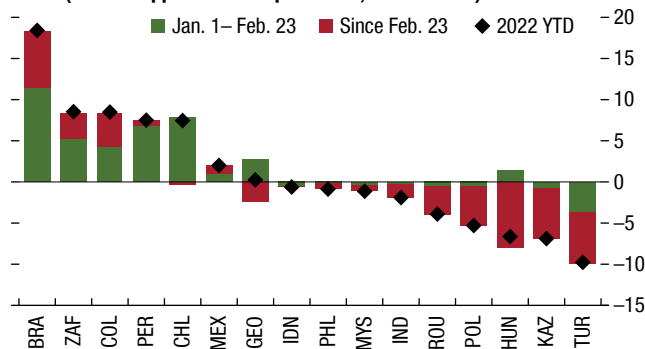
Weaker borrowers and Russia's economic partners have been hit the hardest, but spreads have recovered after the initial shock.

3. Change in Emerging Market Sovereign Bond Spreads (Basis points)



Currencies of Russia's main trading partners have sold off, but commodity exporters have held up.

4. Emerging Market Currencies (Percent appreciation/depreciation, vs. US dollar)



Sources: Bloomberg Finance L.P.; JPMorgan Chase & Co.; and IMF staff calculations.

Note: In panel 3, the Caucasus/Central Asia includes the average of Armenia, Azerbaijan, Georgia, Kazakhstan, and Tajikistan. In panels 3 and 4, data labels use International Organization for Standardization (ISO) country codes. EM = emerging markets; IT = information technology; LatAm = Latin America; YTD = year to date.

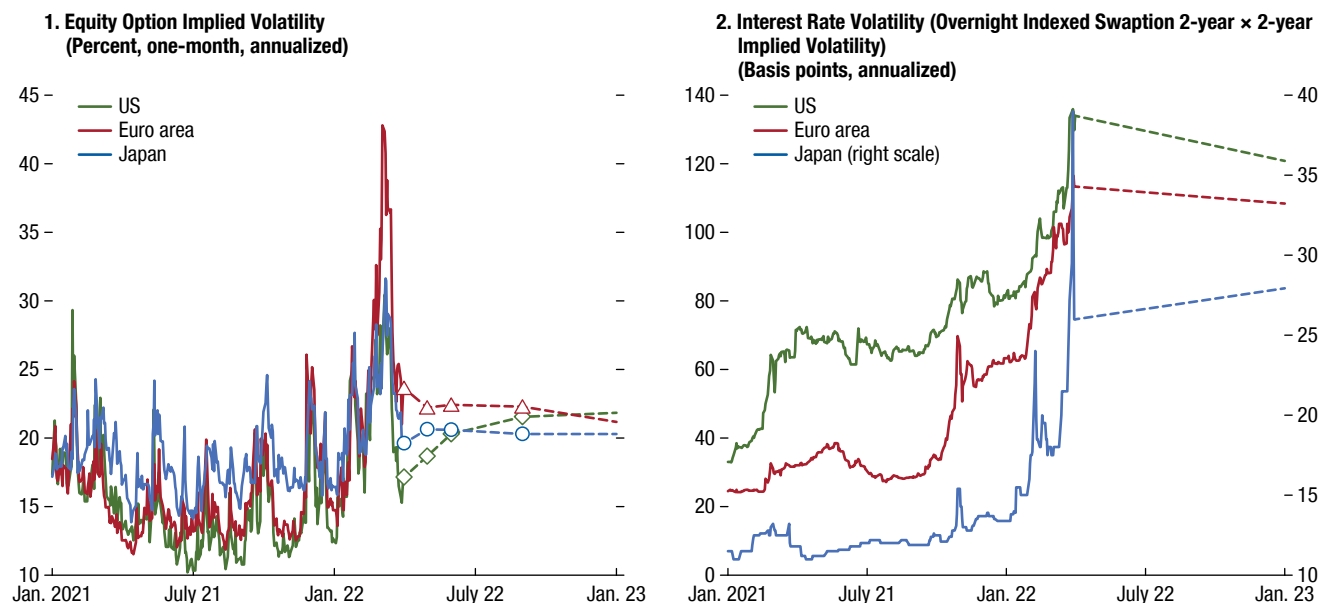
Despite the anticipated economic impact, especially in the war region and Europe, no global systemic event affecting financial institutions or markets has materialized so far. This reflects, at least in part, the increased resilience of the global financial system resulting from the implementation of the financial regulatory agenda following the global financial crisis. However, financial stability risks have risen on several fronts since the Russian invasion of Ukraine, and they may test the resilience of global financial markets amid huge uncertainties, especially should stress interact with preexisting vulnerabilities (see Online Box 1.1⁵

on financial vulnerabilities). Inflation pressure related to surging commodity prices has worsened the policy trade-off faced by central banks, raising concerns among investors about the readiness of central banks to backstop financial markets in the event of sharp declines in asset prices. Moreover, a sudden repricing of risk resulting from an intensification of the war, including a widening of the war beyond Ukraine and Russia, and an associated escalation of sanctions, may expose, and interact with, some of the vulnerabilities that have built up during the pandemic and lead to a sharp decline in asset prices. For example, the recent equity sell-off in China, particularly in the tech sector, combined with ongoing stress in the real estate sector and the increase

⁵Online Box 1.1. is at: www.imf.org/en/Publications/GFSR.

Figure 1.4. Financial Market Volatility Has Picked Up Dramatically

Market volatility has spiked following the war in Ukraine, especially in Europe, but it has fallen notably recently.



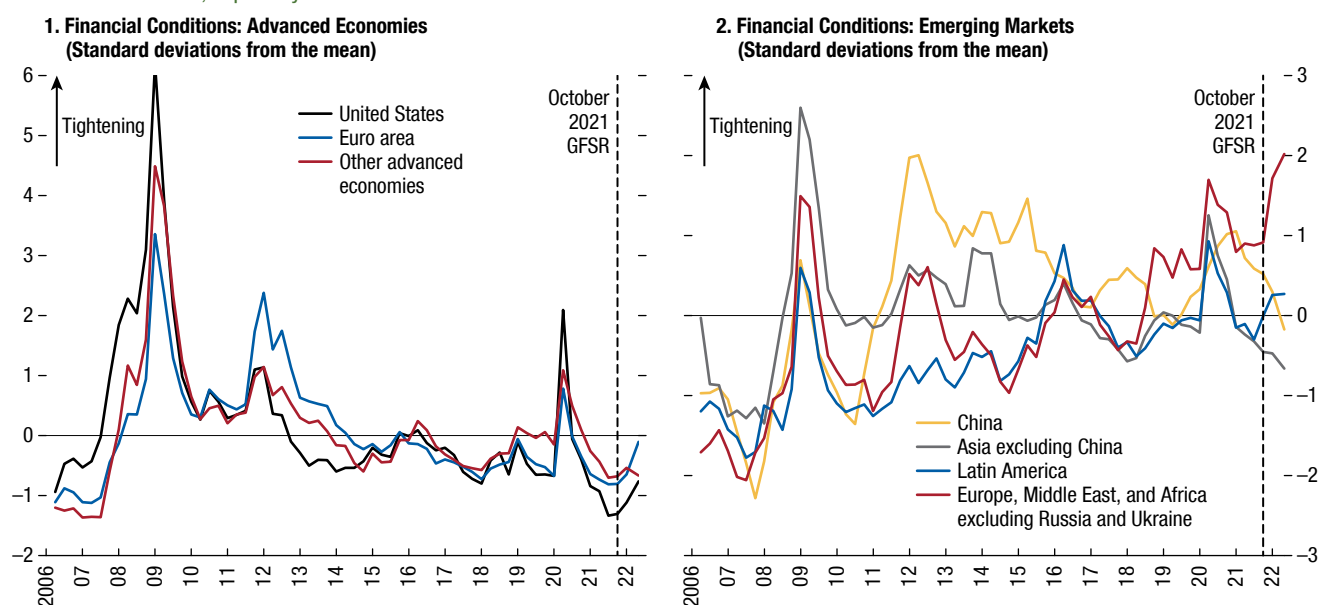
Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Note: In panel 1 and 2, dotted lines indicate forwards. In panel 2, OIS swaption (swap option) refers to an option to enter into an overnight index swap (OIS). EUR = euro; JPY = Japanese yen; USD = US dollar.

Figure 1.5. Global Financial Conditions

Financial conditions have tightened notably on average in Q1 in advanced economies, especially in the euro area ...

... and have reached extremely tight levels in eastern Europe.

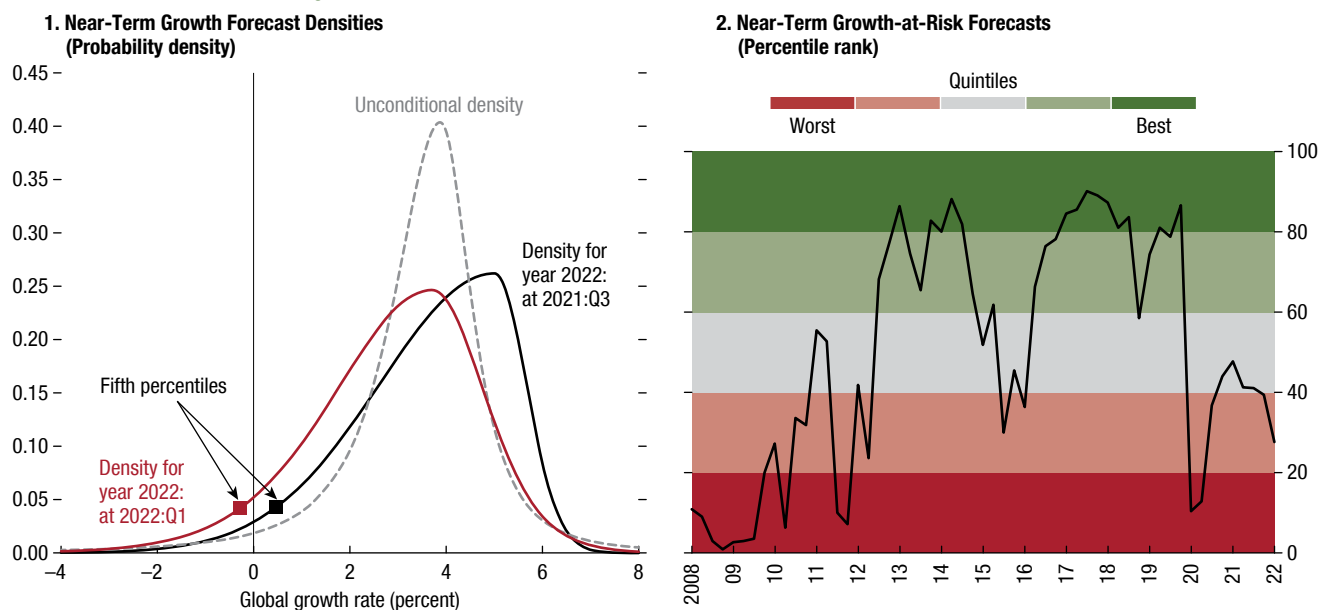


Sources: Bloomberg Finance L.P.; Haver Analytics; national data sources; and IMF staff calculations.

Note: GFSR = Global Financial Stability Report.

Figure 1.6. Global Growth-at-Risk

The downward revision to global growth forecast for 2022 coincides with the balance of risks remaining skewed to the downside.



Sources: Bank for International Settlements; Bloomberg Finance L.P.; Haver Analytics; IMF, International Financial Statistics database; and IMF staff calculations. Note: Forecast density estimates are centered around the World Economic Outlook forecasts for 2022 as at 2021:Q3 and 2022:Q1, respectively. To gauge downside risks over time, in panel 2, the black line traces the evolution of the 5th percentile threshold (the growth-at-risk metric) of near-term growth forecast densities. The color of the shading depicts the percentile rank for the growth-at-risk metric, from 1991 onward. See the April 2018 *Global Financial Stability Report* for details.

in COVID-19 cases, has raised concerns about a growth slowdown, with possible spillovers to emerging markets. In addition, the war has crystallized specific amplification channels of the shock that operate through financial markets—for example through disruptions in commodity markets and widespread counterparty risk concerns that have propagated and weighed on risk-taking appetite across market segments.

Potential transmission channels of the war in Ukraine through global financial markets include inflation pressure related to rising commodity prices; exposures of banks and nonbank financial intermediaries to Russian and Ukrainian assets; disruptions in commodity markets transmitted through commodity trade finance and derivatives; growing concerns about counterparty risks leading to a broad pullback in risk-taking amid poor market liquidity and funding strains; a Russian default on its debt obligations and potential capital outflows from emerging markets; and cyberattacks affecting the resilience of the financial system.

In coming years, policymakers will face a number of structural challenges brought to the fore by the war in Ukraine. These include a change in the perception

of the trade-offs between energy security and climate transition at a time when higher commodity prices and supply disruptions will likely make the transition toward energy renewables more costly and complex; de-globalization and fragmentation of capital markets as a result of recurring geopolitical events, with possible long-term implications for the composition of exchange rate reserves; the risk of fragmentation in payment systems and the creation of central bank digital currency blocs; and more widespread use of crypto assets in emerging markets to bypass capital restrictions and sanctions. These issues are extremely complex in a world where geopolitics is likely to play a major role with respect to asset allocations and uncertainty reigns.

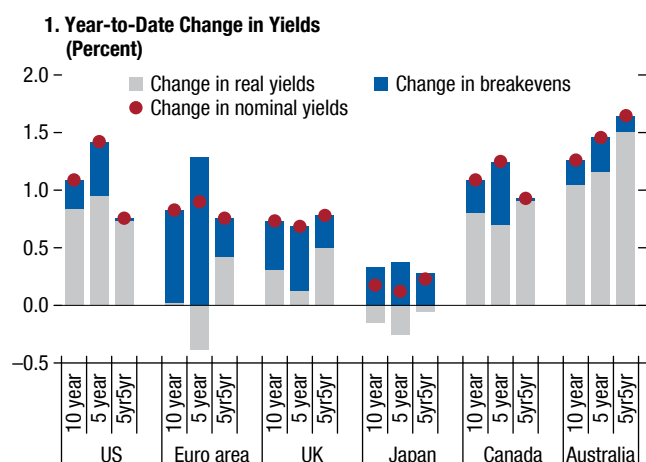
Implications of Higher Commodity Prices for Monetary Policy

Central Bank Normalization in Advanced Economies: Walking a Tightrope amid Stubbornly High Inflation

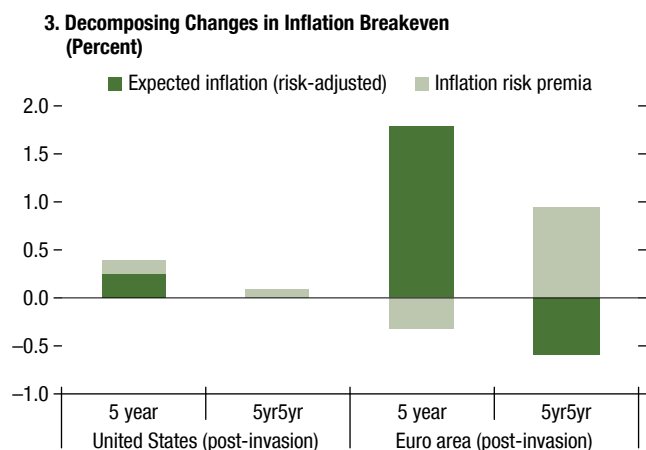
With higher commodity prices expected to add to inflation pressure that has been accelerating since the October GFSR, central banks are faced with a

Figure 1.7. Drivers of Advanced Economy Bond Yields

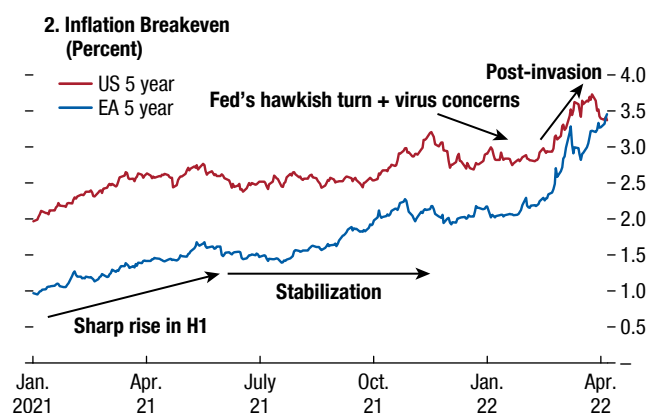
Nominal yields have increased significantly, reflecting rising inflation breakevens and real rates.



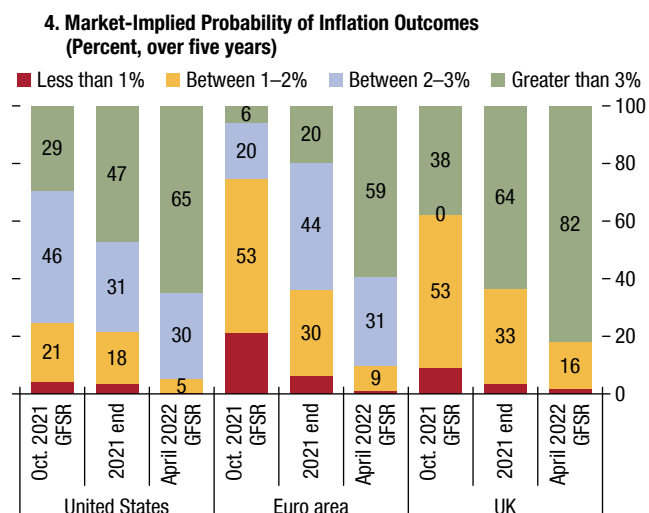
... driven by higher expected inflation in the euro area, and with somewhat higher inflation risk premia playing a role in the United States.



Five-year inflation breakevens have increased sharply since the invasion ...



The probability of high inflation outcomes has increased notably since the previous GFSR.



Sources: Bloomberg Finance L.P.; Goel and Malik (2021); and IMF staff calculations.

Note: In panel 4, probabilities are derived from inflation caps and floors. EA = euro area; 5yr5yr = 5-year, 5-year forward; H1 = first half of the year; GFSR = *Global Financial Stability Report*.

challenging trade-off between fighting multiyear-high inflation and safeguarding the recovery at a time of heightened uncertainty about prospects for the global economy. Bringing inflation down to target and preventing an unmooring of inflation expectations require careful communication and actions to prevent a disorderly tightening of financial conditions. Such a tightening, especially if interacting with financial vulnerabilities, could pose risks to financial stability and weigh on growth.

After rising early in the year on concerns about the inflation outlook, advanced economy nominal bond yields increased sharply in March amid heightened interest rate volatility, reflecting an increase of both breakevens and real rates (Figure 1.7, panel 1). The yield increase accelerated in early April as investors reassessed their outlook for monetary policy following the formal commencement of the normalization process by the Federal Reserve at its March Federal Open Market Committee (FOMC) meeting.

Inflation breakevens (a market-implied proxy for future inflation) have risen significantly since the beginning of the year on the back of sharply higher commodity prices (Figure 1.7, panel 2). Real rates have also increased in a number of advanced economies, on expectations of tighter monetary policy.

The increase in inflation breakevens across countries has been very pronounced at the five-year horizon. In the euro area, such an increase appears to reflect significantly higher expected inflation, while in the United States higher inflation risk premia—an estimated proxy for inflation uncertainty—seem to have also played a role (Figure 1.7, panel 3). Meanwhile, the rise in inflation breakevens at the five-year, five-year forward horizon has been more contained so far, driven primarily by higher inflation risk premia, suggesting that longer-term inflation expectations continued to be largely anchored despite the jump in commodity prices. However, pricing in inflation options markets points to a notable increase in the probability of high inflation—specifically, inflation outcomes greater than 3 percent—since the time of the previous GFSR (Figure 1.7, panel 4).

The market-implied expected path of policy has risen significantly in advanced economies since the beginning of the year and moved further upward since the Russian invasion of Ukraine, as central banks have taken steps to normalize monetary policy amid record-high headline inflation (Figure 1.8, panel 1). In the euro area, the European Central Bank (ECB) has accelerated the pace of tapering its asset purchase program, noting that interest rate increases could follow some time after the end of asset purchases. The Bank of Japan, by contrast, has maintained its ultra-loose policy as inflation has remained subdued.

The Federal Reserve delivered its first policy rate hike at its March FOMC meeting. In addition, the median FOMC participant now anticipates the federal funds rate to approach 2 percent by the end of the year (Figure 1.8, panel 2). In real terms, however, the FOMC-implied stance of policy is expected to remain accommodative at least through 2023 (Figure 1.8, panel 3). Even though the market-implied policy path in 2022 is now above the FOMC participants' assessment of appropriate monetary policy, there is still a risk of a possible repricing of the magnitude of the policy cycle. Historically, once tightening is under way, long-term interest rates eventually tend to move higher (Figure 1.8, panel 4). Such an increase, especially if driven by real rates, may lead to a sudden repricing of

risk that may weigh on economic prospects. Reportedly reflecting concerns about the economic outlook, the US Treasury yield curve has flattened significantly since the beginning of the year, and certain segments of the curve have inverted (Figure 1.8, panel 5).

The normalization of balance sheet policies may present additional challenges to central banks. While policy rates remain the main monetary policy tool, clear communication on plans to unwind the unprecedented expansion of central bank balance sheets—in terms of timing, speed of reduction, and composition of both the asset and liability sides—will be crucial to avoid unnecessary market volatility. To gauge the impact of balance sheet normalization on long-term interest rates, investors have focused on the 2017–19 quantitative tightening (QT) experience, highlighting the risk of a sudden increase in term premia given the larger size of the Federal Reserve's balance sheet and its footprint in some market segments (Figure 1.9, panel 1). The unwinding of the Federal Reserve's balance sheet is expected to be fast, with more than \$1 trillion of assets (approximately 20 percent of the Treasury securities held in the Federal Reserve System Open Market Account portfolio) maturing in 2022 (Figure 1.9, panel 2).

While still low by historical standards, southern European countries' spreads have widened since the ECB's announcements of its intention to scale back asset purchases, underscoring the risk of market fragmentation in the euro area. Between 2020 and 2021, accommodative and supportive market conditions brought about by the ECB's asset purchase programs have helped push spreads lower (Figure 1.9, panel 3). With fiscal deficits and debt levels remaining relatively high in some countries, additional fiscal stimulus in Europe is being considered to cushion the impact of the war in Ukraine (including future defense and climate spending) (Figure 1.9, panel 4). The wind-down of asset purchases may contribute to a tightening of financial conditions.

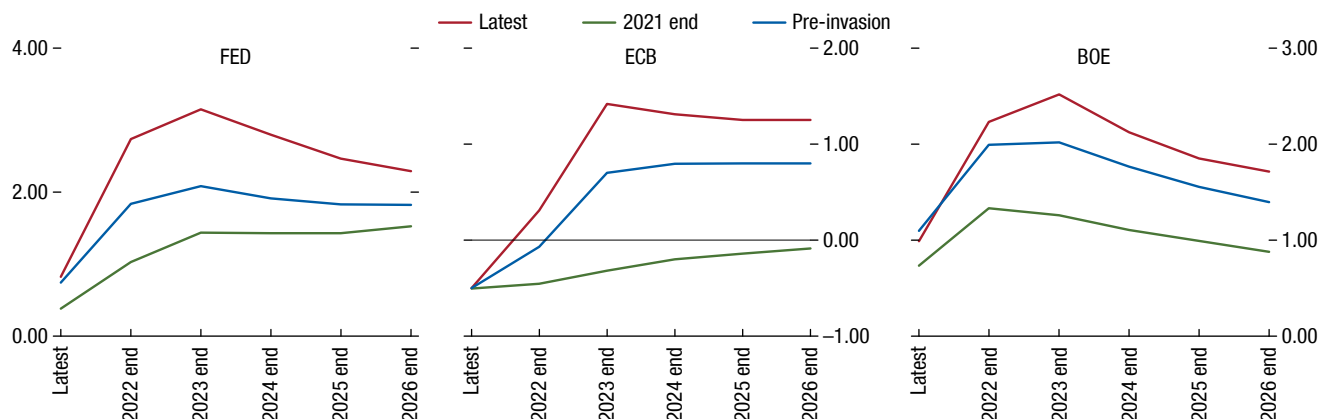
Emerging Market Central Banks Face Further Inflation Pressure

Even before the Russian invasion of Ukraine and the associated surge in commodity prices, emerging market central banks in Latin America and Europe were facing rising inflation pressure. Inflation prints came in well above central bank targets last year, outpacing inflation forecasts (Figure 1.10, panel 1). To maintain market confidence in their ability to meet their mandates,

Figure 1.8. Increase in Advanced Economy Policy Rates

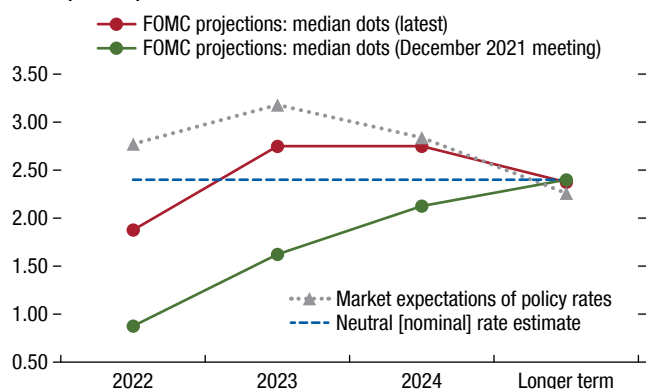
Market-implied expectations of policy rates have risen across advanced economies.

1. Policy Rate Expectations: Advanced Economies (Percent)



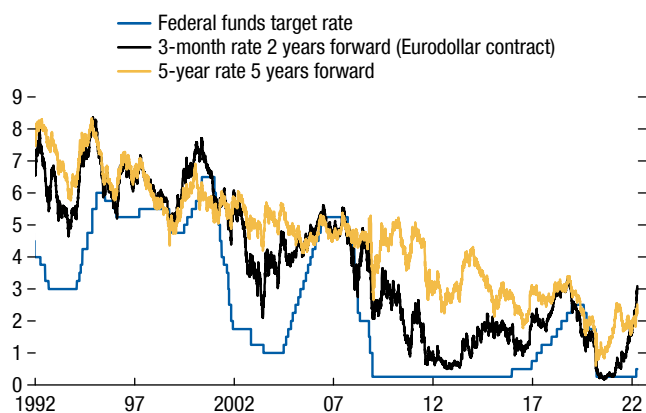
The FOMC assessment of appropriate monetary policy has also moved significantly higher.

2. Shift in US Policy Rate Projections: Nominal Rates (Percent)



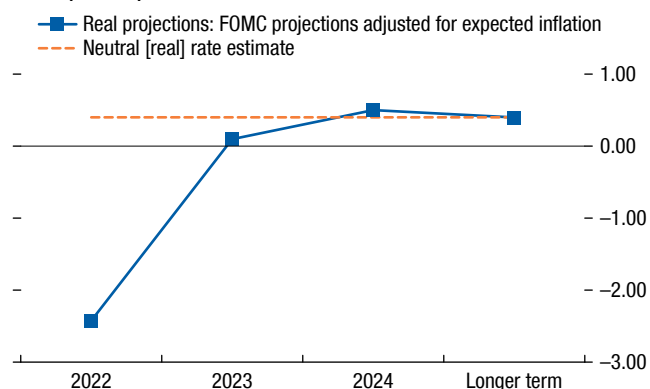
Longer-term interest rates tend to move higher once policy tightening is under way.

4. Long-Term Interest Rates and Policy Tightening (Percent)



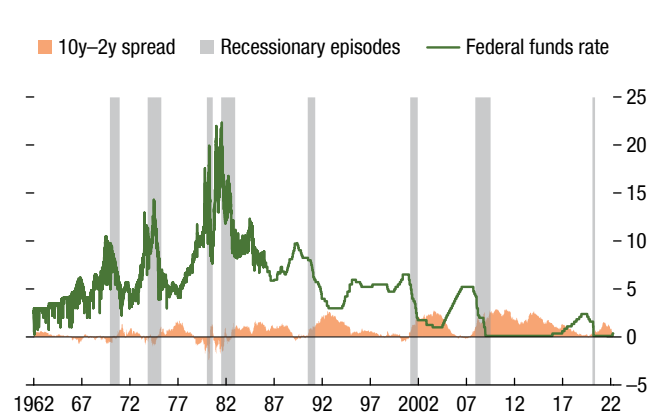
Accounting for expected inflation, however, policy appears to still be relatively accommodative for the current and following year.

3. US Policy Rate Projections: Real Rates (Percent)



The yield curve has flattened significantly since the beginning of the year, reflecting concerns about the economic outlook.

5. US Yield Curve Slope and the Federal Funds Rate (Percent; percentage points)

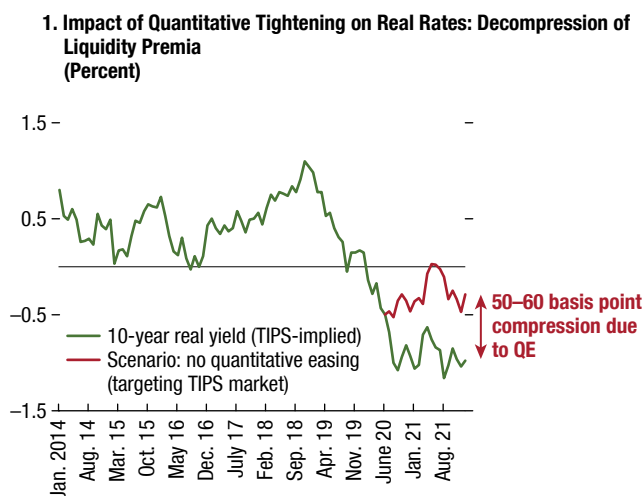


Sources: Bloomberg Finance L.P.; national authorities; US Federal Reserve; and IMF staff calculations.

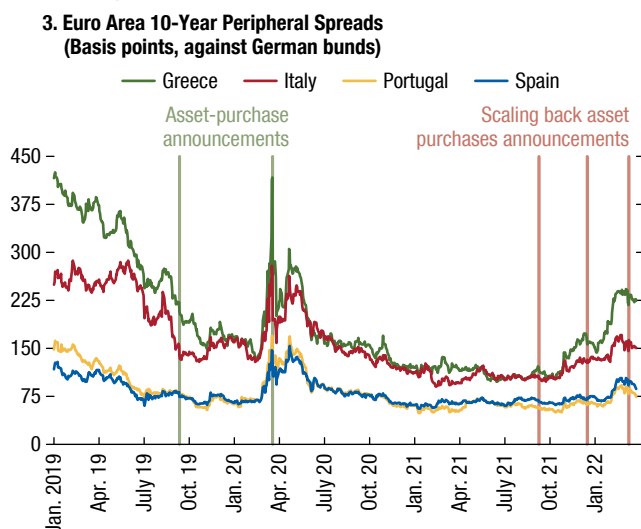
Note: BOE = Bank of England; ECB = European Central Bank; FED = US Federal Reserve; FOMC = Federal Open Market Committee.

Figure 1.9. A Challenging Normalization Process

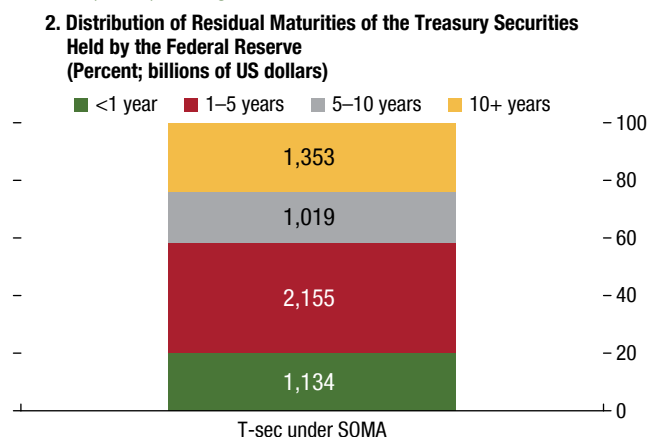
A repricing of risk is possible, as the effects of quantitative tightening on the path of interest rates remain uncertain.



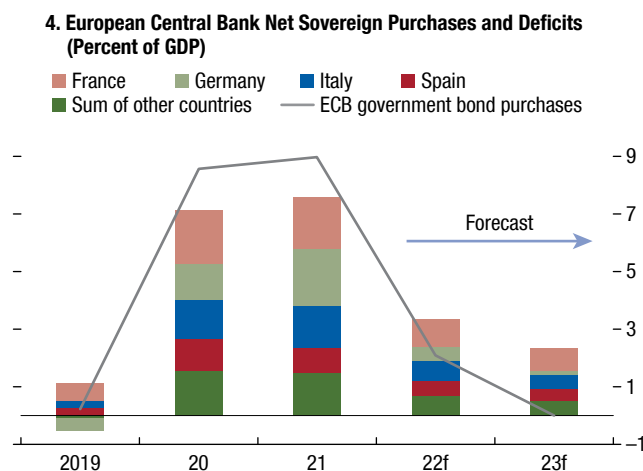
Southern European sovereign yields have exceeded pre-pandemic levels and spreads have widened.



The Federal Reserve's run-off potential in 2022 is approximately 20 percent of the Treasury securities held in the System Open Market Account (SOMA) holdings.



Borrowing needs remain larger compared to pre-pandemic levels and vary across countries.



Sources: Bloomberg Finance L.P.; Federal Reserve; national authorities; and IMF staff calculations.

Note: ECB = European Central Bank; QE = quantitative easing; TIPS = Treasury Inflation Indexed Securities; T-sec = Treasury securities.

many central banks responded decisively and front-loaded policy tightening—a crucial step, as evidenced by the relative stability of longer-term inflation expectations.⁶ Market participants were already pricing that central banks in Latin America and eastern Europe

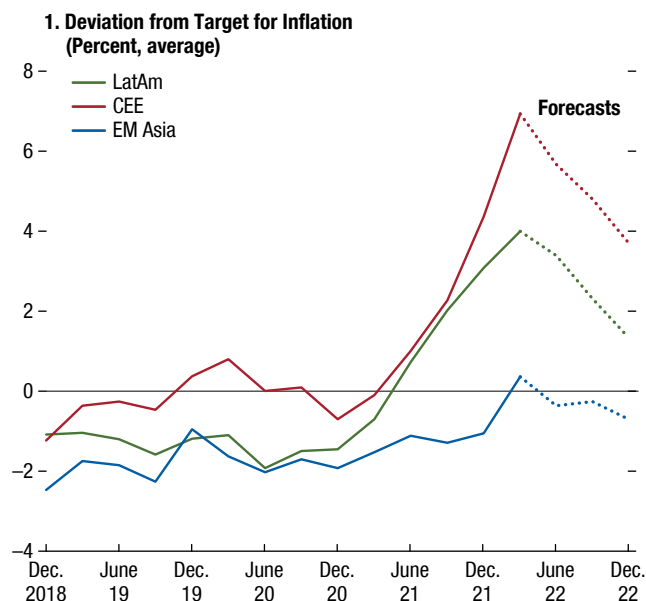
⁶Two notable exceptions are Argentina and Turkey, where inflation expectations remain well above the inflation targets in the relevant policy horizon.

would be able to halt or even reverse earlier hikes within a one-year horizon on the back of an improvement in the inflation outlook (Figure 1.10, panel 2). Meanwhile, investor flows in local currency markets were experiencing a nascent recovery.

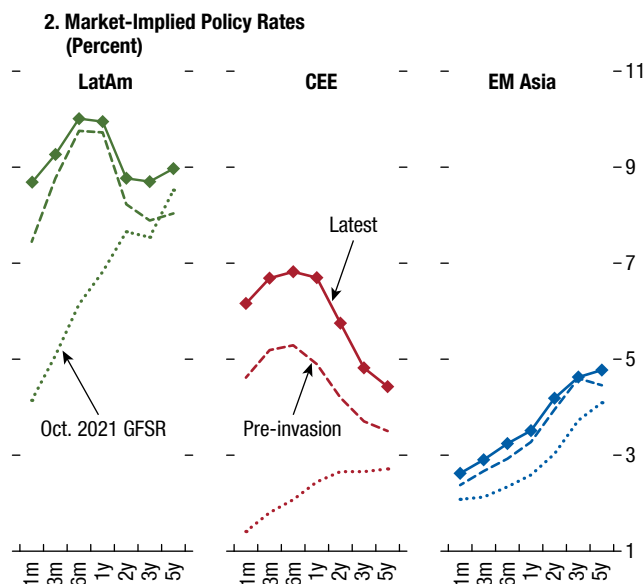
However, the Russian invasion of Ukraine has adversely affected the outlook for many emerging markets. As indicated in the April 2022 WEO, relative to the January 2022 WEO *Update*, the inflation forecast

Figure 1.10. Inflation and Interest Rates in Emerging Markets

Consensus expects that the inflection point for inflation prints is near.



Policy-implied paths differ substantially among regions.



Sources: Bloomberg Finance L.P.; Consensus Forecasts; and IMF staff calculations.

Note: Both charts are based on a sample of countries from CEE = Central and Eastern Europe; EM Asia = emerging market Asia; LatAm = Latin America. Panel 1 uses the upper limit of the inflation targeting framework where available. GFSR = *Global Financial Stability Report*.

for emerging market and developing economies for 2022 has been revised up 2.7 percentage points to 8.6 percent, while the GDP forecast for 2022 has been revised down 0.9 percentage point to 3.9 percent. The war in Ukraine has had a larger impact on economies in central and eastern Europe, where a notable tightening of financial conditions has been accompanied by currency interventions (and restrictions such as by Russia and Ukraine), and a shift to an even more hawkish monetary policy stance in some cases. The rise in commodity prices has been swiftly felt in most countries with direct trade links to Russia and Ukraine, creating further upside risks to inflation. In addition to a shift to a more hawkish stance of monetary policy, some countries (such as Egypt) have also taken the opportunity to use the exchange rate as a shock absorber.⁷ By contrast, commodity exporters across emerging markets, such as Brazil, Chile, and South Africa have

⁷Other countries also had to resort to measures to stem outflows of foreign exchange given the spike in demand for foreign exchange and logistical difficulties in sourcing foreign exchange. For example, Kazakhstan banned people leaving the country with more than \$10,000 and imposed restrictions on gold and silver departures.

seen an improvement in their terms of trade and a relatively milder impact on financial conditions. This has provided central banks with more space to calibrate monetary policy to domestic developments. Emerging market economies in Asia that have limited direct links to Russia and Ukraine and a more benign inflation outlook have continued with their more delayed and gradual policy normalization.

Transmission Channels of the War through Financial Intermediaries and Markets

The Russian invasion of Ukraine and ensuing sanctions have already had an impact on financial intermediaries, firms, and markets directly or indirectly exposed to the war. Europe bears a higher risk than other regions due to its proximity, reliance on Russia for energy needs, and non-negligible exposure of some banks and other financial institutions to Russian financial assets and markets. But the war is also generating broader concerns well beyond Europe. Rising risk aversion has led to flight-to-quality flows and signs of strains in dollar-funding markets. Extreme volatility in commodity markets has resulted in ripple effects

across global markets and financial intermediaries, often magnified by poor liquidity, leading to lower risk appetite, rising counterparty risk concerns (for example, in relation to commodity financing and derivatives), and supply chain disruptions. The prospect of a Russian default on government debt and the removal of Russian assets from global indices would have implications for emerging market capital flows. Cyberattacks have become a first-order concern for financial institutions and policymakers alike. These factors can operate as shock amplifiers and, in some cases, lead to severe market disruptions.

Foreign Banks' Direct Exposures to Russia and Ukraine: Relatively Modest, in Aggregate

Direct exposures of foreign banks to Russia and Ukraine appear to be relatively modest, in aggregate (Figure 1.11, panel 1).⁸ As of the third quarter of 2021, claims of foreign banks on Russian residents totaled about \$120 billion, with 60 percent in foreign currencies. For Ukraine, exposures were relatively small at \$11 billion. The vast majority of these exposures were held by euro area banks. For some countries, these exposures were economically significant, as individual banks play an active role in the Russian banking system (Figure 1.11, panel 2). Because they operate as subsidiaries, however, they typically fund themselves locally; as a result, intra-group loans are generally small.

The market capitalization of European banks declined sharply after the Russian invasion (Figure 1.11, panel 3). While banks with large exposures to Russia and Ukraine experienced the largest declines, an index of European bank equity prices fell over 20 percent after February 24, reflecting in part concerns about a deterioration of the economic and profitability prospects.⁹ By contrast, equity prices of US banks dropped only about 8 percent at the worst point.

⁸The actual exposures are likely higher, as some countries are not included in the aggregate data. However, according to bank disclosures or statements in 2022:Q1, exposures have likely decreased since 2021:Q3.

⁹The cost of equity (CoE) for European banks increased from 11 percent to 16.5 percent after the invasion, before recovering to modestly above the pre-invasion level. A capital asset pricing model shows that the increase in CoE has been driven by a rise in the European equity risk premium and amplified by higher sensitivity (beta). This is consistent with higher expected losses associated with Russian exposures, alongside a more challenging macroeconomic outlook.

Meanwhile, the increase in European bank credit default swap (CDS) spreads has been more modest, suggesting that investors expect the impact of the war and sanctions on banks' balance sheet and capital to be manageable. Banks with Russian subsidiaries can choose to either exit the market entirely or maintain their presence but prepare for a sharply worsening revenue and asset quality outlook. The exit strategy is estimated to reduce the common equity Tier 1 (CET1) ratio at the group level by an average of 20 basis points, with an impact about four times larger for the most exposed bank (Figure 1.11, panel 4).¹⁰ However, cross-border exposures are likely to be either pulled back or experience some losses, in which case the total impact could reach an average of 80 basis points (about 2½ times the impact for the most exposed bank).

Indirect Exposures: More Difficult to Assess

Banks' indirect exposures are more difficult to identify and assess because they are less well known (especially the extent of interconnectedness) and hard to quantify in the absence of detailed and consistent disclosures by country or specific activity types. The risk is that indirect exposures could be meaningful and surprise investors once revealed, leading to a sharp rise in counterparty risk and risk premia. These exposures could result from activities such as investment banking and wealth management, derivatives (including commodity derivatives),¹¹ and off-balance-sheet exposures related to supply chain or commodity financing, as well as contingent liabilities and guarantees.¹² In some cases, these exposures to Russian counterparties could be large. For example, foreign exchange swap and forward contracts, unlike other derivative instruments, involve the exchange of notional amounts and are akin to collateralized lending. As such, gross positions matter, as they expose institutions to significant counterparty and settlement risks, notably in situations where foreign currency settlement is restricted.

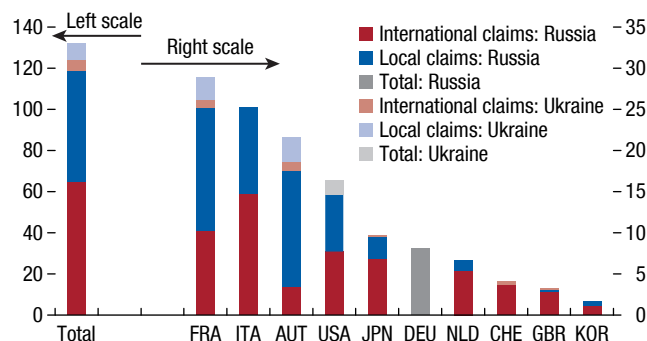
¹⁰The exercise assumes loss of equity, intra-group funding, and subordinated debt at the Russian subsidiary level, and de-consolidates the associated risk-weighted assets. Loss from cross-border exposures was considered as an additional shock, assuming a 100 percent haircut in the worst scenario.

¹¹Commodity derivative exposure from euro area banks that are designated as significant institutions stood at 52 million euros, according to an ECB assessment as of March 15, 2022.

¹²Typically, trade finance has public or private insurance as risk mitigation.

Figure 1.11. Foreign Bank Exposures to Russia and Ukraine

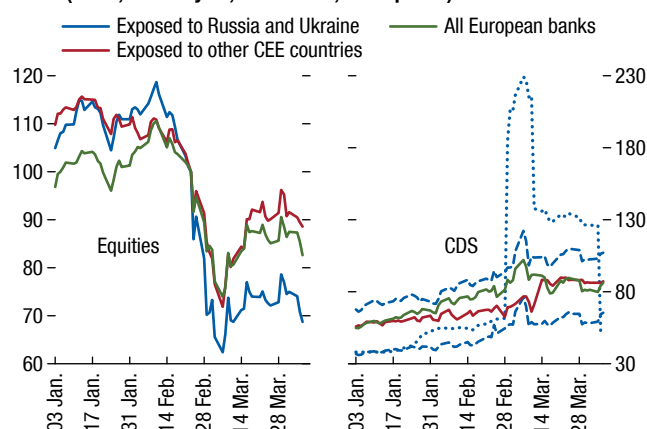
Direct exposures to Russia and Ukraine are modest in aggregate ...

1. Foreign Banks' Gross Claims on Russia and Ukraine (Billions of US dollars)

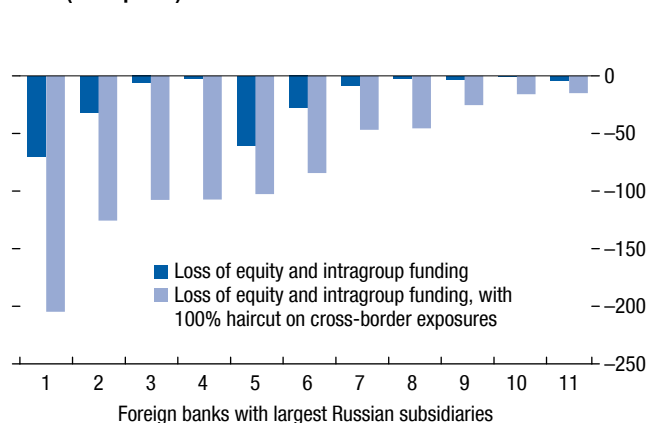
... but are sizable at some banks.

2. Banks with Largest Exposures to Russia, Ukraine, and Central and Eastern Europe Countries (Percent of total assets)

There have been sharp declines in bank stocks and a relatively modest increase in credit default swaps ...

3. Stock Price and Credit Default Swap Spreads (Index, February 23, 2022 = 100; basis points)

... as the capital impact appears manageable for most.

4. Foreign Bank Exit: Potential Impact on Group CET1 Ratios (Basis points)

Sources: Bank for International Settlements, Consolidated Banking Statistics; European Banking Authority; Bloomberg L.P.; individual bank disclosures; and IMF staff calculations.

Note: In panel 3, the blue-colored lines on the right chart refer to three different banks with material exposures to Russia and Ukraine. In panel 4, see footnote 15 for details. Data labels use International Organization for Standardization (ISO) country codes. CDS = credit default swaps; CEE = central and eastern Europe; CET1 = Common Equity Tier 1.

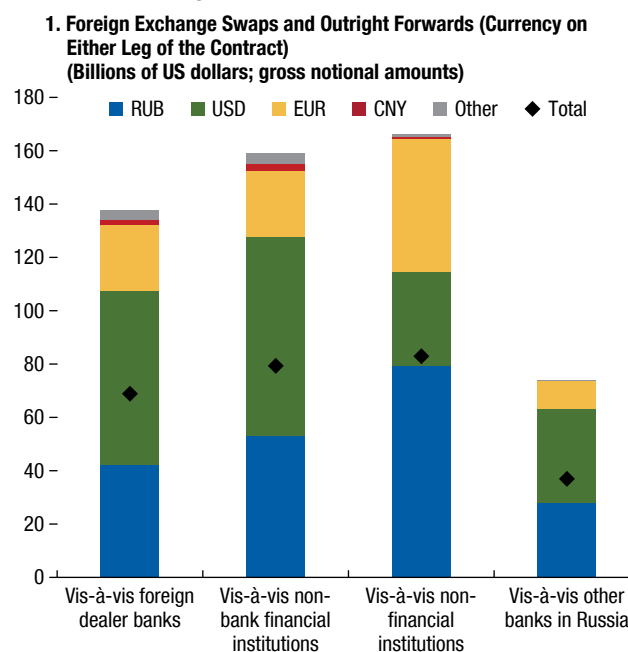
Before the war, Russian banks had entered into foreign exchange swaps and forwards contracts with foreign dealer banks. Typically, Russian banks would lend US dollars against a pre-agreed amount of Russian rubles (the gross notional amount), as they received large amounts of dollar deposits (and, to a lesser extent, euros) from their clients.¹³ The total gross notional amount of over-the-counter foreign exchange swaps

and forwards between Russian banks and foreign dealer banks amounted to about \$69 billion at the end of 2021 (Figure 1.12, panel 1, first bar, black diamond). To the extent that foreign dealer banks have received dollars, a default by Russian banks would have limited spillovers in the foreign exchange derivatives market, as foreign banks would be left holding US dollars. Even if that is the case, however, the termination of the foreign exchange derivatives exposures may leave both foreign and Russian banks with unhedged exposures. The Russian banks would be left with a currency mismatch against their domestic depositors, while foreign banks would have to find new

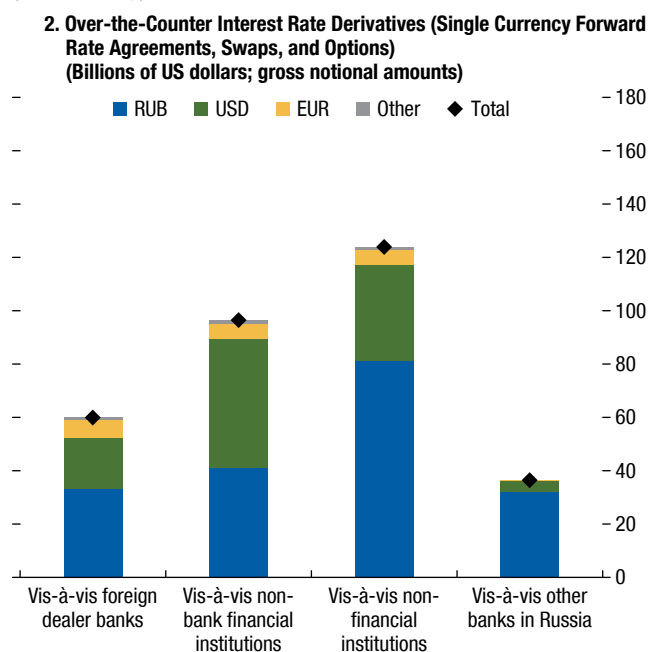
¹³Banks in Russia had around \$220 billion US dollar deposits as of the end of September 2021, according to Bank for International Settlements locational banking statistics.

Figure 1.12. Over-the-Counter Derivative Exposures of International and Domestic Banks in Russia, End-2021

Foreign exchange derivative exposures of foreign dealer banks to banks in Russia is significant ...



... while over-the-counter interest rate derivative exposures are smaller (and less risky).



Sources: Central Bank of Russia; and IMF staff calculations.

Note: As foreign exchange swap and forward contracts involve the exchange of two currencies, the sum of outstanding notional amounts across individual currencies (for either leg of the contract) in panel 1 is exactly double the total outstanding amount. Foreign dealer banks include the subsidiaries and branches of these banks located in Russia. Over-the-counter interest rate derivatives are generally subject to clearing requirements, although for contracts in Russian rubles clearing has only been mandatory for interest rate swaps since the last quarter of 2021. Such swaps typically constitute the bulk of outstanding amounts (>75% of the global total). CNY = Chinese yuan; EUR = euro; RUB = Russian ruble; USD = United States dollar.

instruments to hedge any outstanding ruble exposures. Outstanding amounts of over-the-counter interest rate derivatives, which require only an exchange of interest payments, are generally lower than foreign exchange gross notional amounts, and clearing requirements help to contain counterparty risk exposures (Figure 1.12, panel 2).

Nonbank Financial Intermediaries: Coping with a Potential Russian Default

Foreign nonbank financial intermediaries (NBFIs) had sizable investments in Russian assets, holding about one-fifth of its total sovereign debt, half of its corporate debt, and more than 40 percent of Russian equities as of the fourth quarter of 2021 (Figure 1.13, panel 1).¹⁴ Within the NBF sector, open-end investment funds (OEFs), which offer mostly daily liquidity and are

therefore at greater risk of redemption pressures, have exposures to Russian equities of about \$100 billion, the vast majority of which is held by US funds (Figure 1.13, panel 2). OEFs also have a combined \$34 billion in fixed-income assets, about two-thirds of which is held by European funds. As a share of total assets, however, their exposure to Russia is small. Even for European funds, which display the largest portfolio shares in Russian debt and equities, aggregate exposures are less than 2 percent of funds' assets.

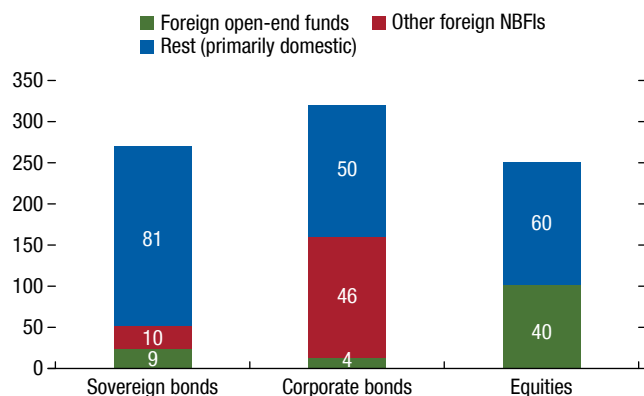
Within the OEFs, emerging-market-dedicated funds hold the vast majority of Russian debt and equity. However, even these funds have maintained a cautious stance on their exposures to Russian debt since the Crimea occupation in 2014, particularly for the hard-currency bond funds subcategory (Figure 1.13, panel 3). Emerging market dedicated funds reduced their share of Russian debt from over 10 percent prior to 2014 to just over 4 percent in 2022. In fact, heading into the 2022 Russian invasion, these funds had (on average) an underweight position compared to their

¹⁴The estimate for equities is likely to be higher, as there is only data available for the holdings of foreign open-end funds, with the latter holding an estimated 40 percent of the market cap of Russian equities.

Figure 1.13. Exposure to Russian Assets by Foreign Nonbank Financial Intermediaries

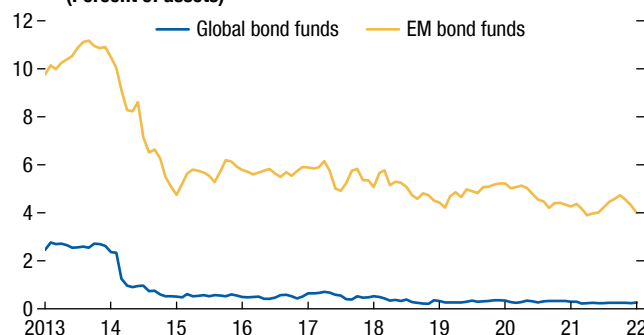
Foreign nonbank financial intermediaries hold a sizable amount of Russian securities ...

**1. Russian Sovereign Debt, Corporate Debt, and Equities
(Billions of US dollars; percent)**



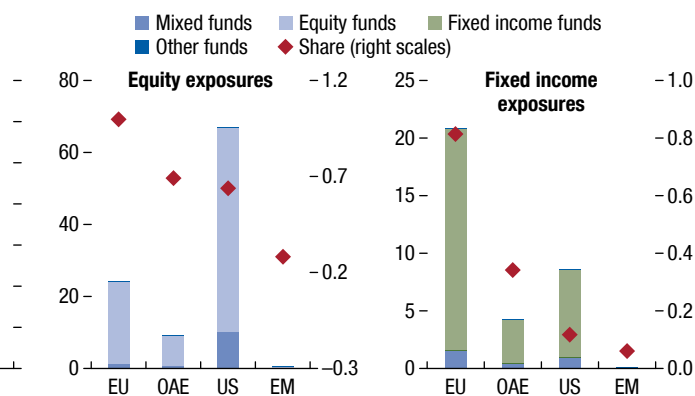
The share of Russian bonds in the portfolios of emerging-market-dedicated bond funds has declined since 2015 and is negligible for global funds ...

**3. Open-End Bond Fund Portfolio Allocation to Russia
(Percent of assets)**



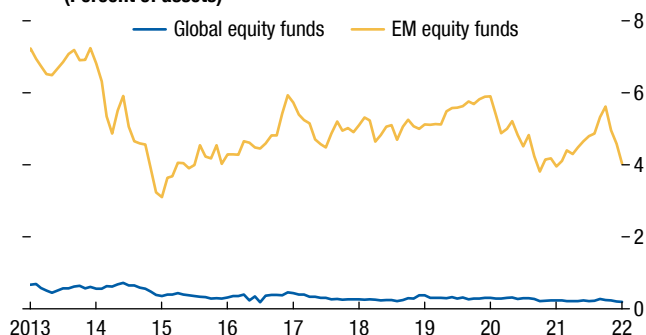
... with US and European investment funds accounting for most of the exposures.

**2. Open-End Investment Fund Exposure to Russian Sovereign Debt, Corporate Debt, and Equities
(Billions of US dollars, left scales; average portfolio share, percent, right scales)**



... and a similar pattern prevails for equity funds.

**4. Open-End Equity Fund Portfolio Allocation to Russia
(Percent of assets)**



Sources: Arslanalp and Tsuda (2014, updated); Bloomberg Finance LP; Haver Analytics; JPMorgan Chase & Co.; Morningstar; and IMF staff calculations.

Note: In panel 1, the “other foreign NBFIs” category for corporate bonds includes all intermediaries that are not open-end funds, including sovereign wealth funds, close-end funds, pension funds, hedge funds, and others. The “rest” category in panel 1 for equities also includes foreign NBFIs outside of open-end funds due to the lack of available data. The market cap of the MOEX index is used as a proxy for the total value of Russian equities. The total value of both Russian sovereign and corporate bonds outstanding includes both foreign and domestic currency bonds. EM = emerging markets; EU = European Union; NBFIs = nonbank financial intermediaries; OAE = other advanced economies; US = United States.

emerging market benchmark (more on this follows). In contrast to emerging-market-dedicated funds, funds benchmarked to global indices had a much smaller exposure to Russia (in both absolute and relative terms), with an average 0.2 percent of their assets invested in Russian debt in 2022.¹⁵ On equities, the share of

Russian exposure in emerging-market-dedicated funds stood at 4 percent of total assets before the invasion, while for global equity funds it was less than 0.2 percent. Since the Russian invasion of Ukraine, the very sharp drop in valuations of Russian assets has dramatically reduced the market value of investment funds' exposures to Russia. Some regulators have started to consider options to isolate Russian assets from broader portfolios by, for example, allowing the separation of the Russian exposures into so-called side pockets, which are portfolio tranches exclusively owned by

¹⁵Separately, unconstrained global multi-sector bond funds (MSBFs) hold over 1 percent of Russia's total sovereign debt stock, but this exposure is also small when measured as a percentage of assets. However, these funds may have exposure to derivative contracts, which could be subject to greater losses.

existing investors and are temporarily not available for redemption.¹⁶

Some NBFIs, such as specialized insurers and leasing companies, may also be facing greater risks in the areas of cyber underwriting, trade credit, and aircraft leasing. The war in Ukraine has intensified the risk of offensive cyber operations, with a potentially adverse impact on financial stability in the region and beyond. Despite the relatively small size of cyber insurance (estimated at \$8 billion globally), it has experienced rapid growth amid concerns about the uncertainty of expected losses against which insurers have to reserve and hold capital.¹⁷ Aircraft leasing companies, many of which are domiciled in Ireland, are also exposed to potential large losses if Russia refuses to return leased aircraft. Finally, foreign providers of trade credit are also exposed to Russia, with an estimated \$16 billion of trade credit as of the last quarter of 2021.

Foreign sanctions as well as capital controls and other retaliatory measures imposed by Russia have increased risks for foreign investors in Russian securities. Payments to foreigners are not explicitly forbidden by the current set of sanctions, but actions taken by Russian and other international securities depositories (ICSDs), along with the freezing of some of Russia's international reserves, have made payments more difficult.¹⁸ At the time of writing, Russian authorities have continued servicing Russia's foreign law debt in hard currency but have suspended the transfer of payments to foreigners on local law ruble-denominated bonds. The latter action has not created major complications to foreign law debt given that foreign law bonds and CDS do not contain cross-default terms with local law bonds (Figure 1.14, panel 1). However, further sanctions could prevent bonds from trading in

the secondary market, which would hamper the CDS settlement process.

In addition to disappearing liquidity and rising credit risk, investors face significant challenges in terms of the valuation of their financial instruments. For example, some foreign investors have positions in non-deliverable forwards (NDFs) that settle in dollars but use the onshore foreign exchange rate as the reference rate. The NDF positions can help them hedge their currency exposures without having to sell their highly illiquid positions in local-currency-denominated assets. Since the start of the war, the Russian central bank has kept tight control on the onshore foreign exchange market,¹⁹ and the Ukrainian central bank has not updated the daily foreign exchange rates. The Russian and Ukrainian exchange rates in offshore markets have diverged from the onshore rates, rendering the NDFs as ineffective hedges (Figure 1.14, panel 2). The sanctions and valuation differences between onshore and offshore markets can also be a problem for foreign banks that have foreign exchange derivatives exposures vis-à-vis Russian banks.

The reduced investability of Russian assets has led to their exclusion from multiple benchmark indices largely used by emerging-market-dedicated funds.²⁰ The sharp drop in the liquidity of Russian securities and the reduced convertibility of the ruble were some of the key reasons behind the decisions of benchmark providers. Global bond benchmarks (as opposed to emerging-market-specific benchmarks) are reliant on Russia maintaining an investment-grade rating, which is no longer the case. Environmental, social, and governance (ESG) related indices have also excluded Russian assets. While these ESG indices are relatively smaller in size, they are growing fast and reflect investors' increasing focus on the ESG dynamics for emerging markets. Finally, Ukraine's inclusion in the JPMorgan Government Bond Index-Emerging Markets (GBI-EM) index family, which was scheduled for March 31, 2022, is now subject to a further review given the current circumstances. This inclusion was expected to bring additional flows to the local market and help with market deepening.

¹⁶The United Kingdom's Financial Conduct Authority is currently discussing the option of side pockets with asset managers (FCA 2022). In general, side pockets and gates—temporary redemption stops—are permitted in several European jurisdictions as liquidity management tools used by open-end investment funds (ESMA 2020).

¹⁷The limited loss history of cyber events, the unreliability of past data when predicting future events, and the possibility of a large-scale attack where losses are highly correlated across firms and sectors make it difficult to write comprehensive policies (Granato and Polacek 2019).

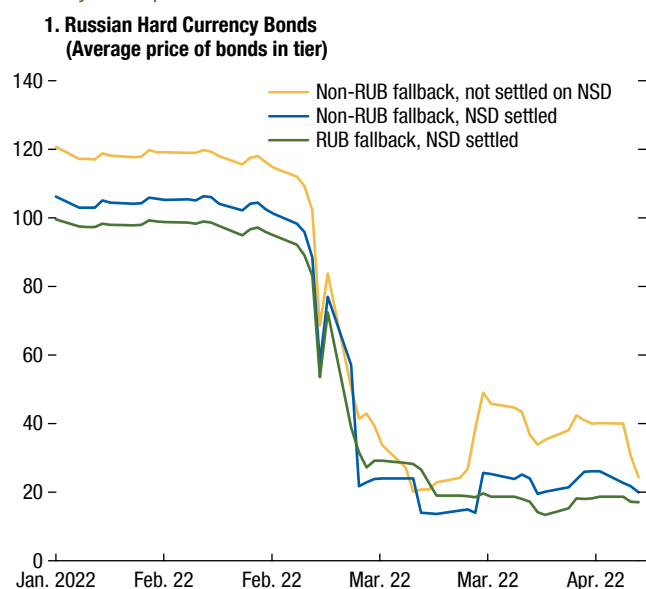
¹⁸The US Treasury has stated that US persons are authorized to receive interest, dividend, or maturity payments on debt or equity of the Central Bank of the Russian Federation, the National Wealth Fund of the Russian Federation, and the Ministry of Finance of the Russian Federation through May 25, 2022.

¹⁹Normally, the Russian central bank provides daily fixings (official rate) of the exchange using transactions in the local market. However, trading in local markets has been severely impaired by various restrictions such as the shutdown of the stock exchange for several weeks.

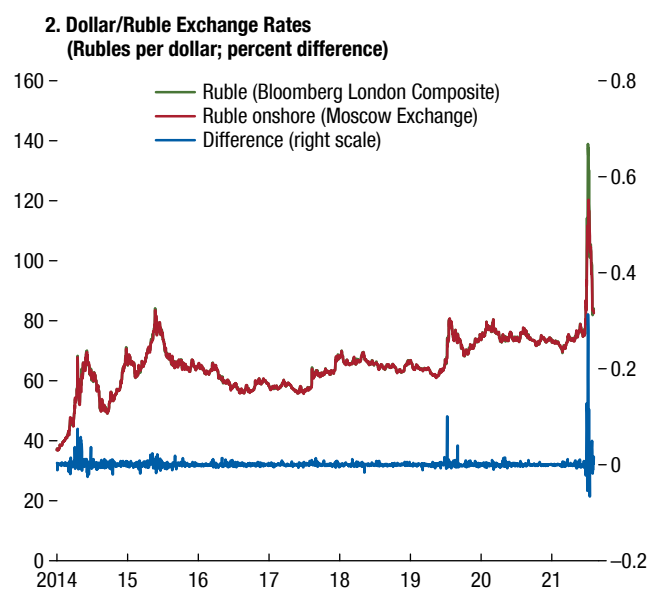
²⁰Similar issues apply to Belarusian assets.

Figure 1.14. Investor Challenges in Russian Security Markets

Russian hard currency bonds trade in three tiers depending on recovery assumptions.



Sanctions and other restrictions have created a notable disconnect in the ruble market.



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Note: In panel 1 "RUB fallback" refers to a provision that allows these bonds to be repaid in rubles under certain conditions. NSD = Russian National Settlement Depository; RUB = rubles.

The index exclusion of Russia is a notable event because benchmark-driven investors have become a key source of intermediating cross-border flows to emerging markets.²¹ While the index exclusion adds to price pressures and illiquidity, Russia's weight in the indices has declined sharply in the past few years. Its median weight across major indices dropped from 10 percent during the global financial crisis to just 3 percent before the Russian invasion of Ukraine, and less than 1 percent immediately thereafter, largely due to valuation declines (Figure 1.15, panel 1).

Russia's exclusion from benchmarks could lead to some positive portfolio reallocation flows to other emerging markets, as their benchmark weight will mechanically increase. Investors could also choose to reallocate funds to other emerging markets that shared similarities with Russia before the war. For instance, the 2014–15 Russian annexation of Crimea led to a foreign investor exit from Russian local assets, while foreign ownership in other high-yielding emerging markets rose

at the same time (Figure 1.15, panel 2). Investors could also gain exposure to countries that benefit from the current macro backdrop, such as commodity exporters.

Commodity Price Volatility Amplified by Commodity Trade Finance and Derivatives Exposures

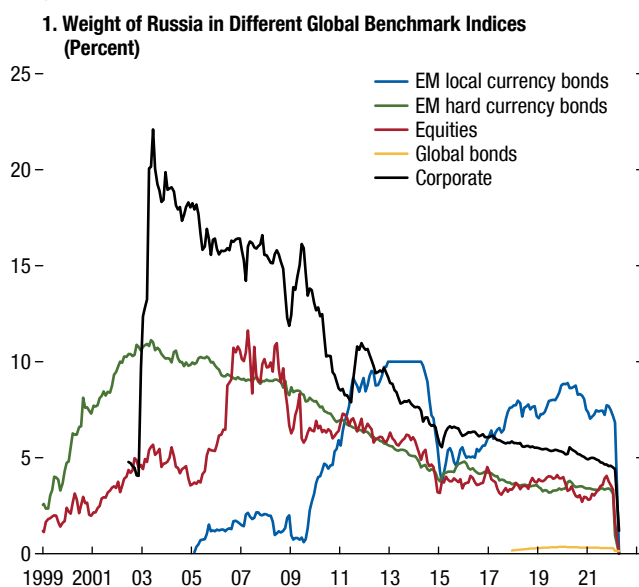
The ongoing war in Ukraine, associated sanctions, market participants' actions in response to the global outcry, and rising counterparty risk have caused severe disruptions in commodity markets and supply chains across the globe (Blas 2022).²² Amid sharply rising volatility, prices have skyrocketed across the commodity complex, causing severe pressures in commodity financing and derivatives markets. Shipping costs of commodities have increased, and higher commodity prices have raised the financing needs of commodity traders and those involved along the supply chain. In addition, users of commodity derivatives (including commodity producers using futures or options for hedging purposes, commodity trading firms, dealer banks, levered investors

²¹JP Morgan's March 2022 client survey showed that nearly half of participants plan to divest as much of their Russian debt holdings as possible and hold the rest off-index, while nearly a quarter plan to continue investing.

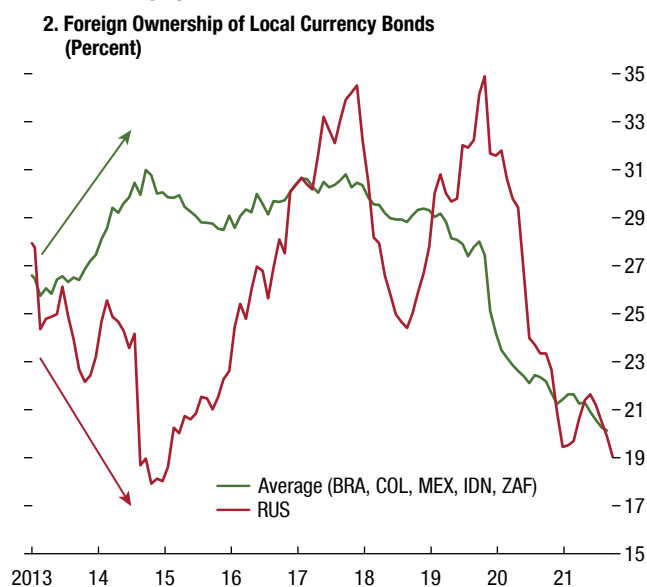
²²The European Union banned imports of certain metals from Russia and the United States banned oil, gas, and coal imports.

Figure 1.15. Impact from Russia's Exclusion from Global Benchmark Indices

Russia's weight in global benchmark indices has declined sharply over the years.



Foreign ownership trends can diverge meaningfully between Russia and other emerging markets.



Sources: Bloomberg Finance L.P.; JPMorgan Chase & Co.; and IMF staff calculations.

Note: In panel 1, EM local currency bonds refers to JPMorgan Government Bond Index, EM hard currency bonds refers to JPMorgan Emerging Market Bond Index, global bonds refers to Bloomberg Barclays Global Aggregate Index, and corporate refers to JPMorgan Corporate Emerging Market Bond Index. Data labels use International Organization for Standardization (ISO) country codes. EM = emerging markets.

like hedge funds, and investment funds) have faced massive margin calls on short positions in response to huge swings in commodity prices, testing the resilience of corners of global financial markets that were little known by the broader public only a few weeks ago (see Box 1.1 on the nickel market disruption).²³

Dealer banks play a crucial role and have significant exposures in commodity markets, so there is a risk they may become a propagation channel of commodity market disruptions. They provide collateralized funding to finance the shipment of commodities. In addition, they provide leverage to some investors and act as intermediaries in commodity derivatives markets. For example, when commodity producers enter into a (short) future position to hedge against a drop in (future) commodity prices, dealer banks take the opposite side (long) of this trade. In turn, they then hedge their book by entering

into an opposite trade (for example, on an exchange).²⁴ Furthermore, they often offer lines of credit to their clients, which can be used at times of acute liquidity needs.

A concern raised by some market participants is that, in response to large swings in commodity prices, differences in initial margin modeling and the prevalence and frequency of posting variation margins appear to be incentivizing some derivative users to trade bilaterally with broker dealers instead of centrally cleared trades, because doing so may offer lower likelihood of large increases in initial margins and of demand for posting more variation margins in times of stress.²⁵ As a result, dealer banks may be exposed to higher margin calls by

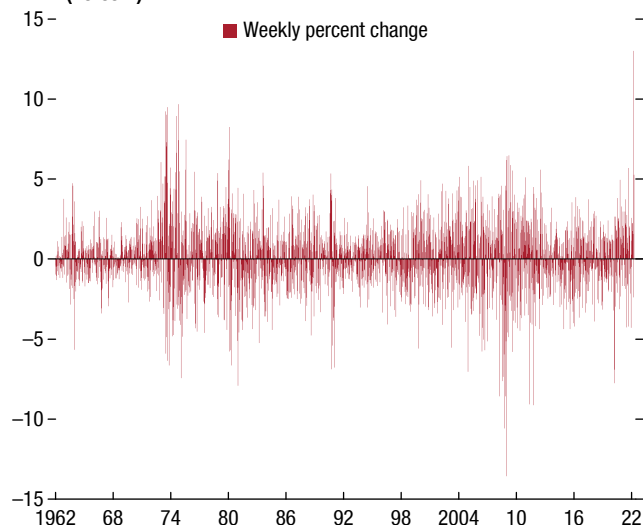
²³Commodity producers are important users of commodity derivatives, often hedging against a drop in future commodity prices. Other participants in the commodity derivatives market include large commodity trading houses (see ECB 2017) and leveraged investors. Large investment banks operate as intermediaries in commodity financing and commodity derivatives, as well as providers of leverage to some of these investors.

²⁴In the event of a sharp increase in prices, banks are owed money from commodity producers that face margin calls on short futures positions, but also owe money to the exchange on their own short positions used as a hedge—so they themselves face margin calls. If the producers are unable to meet margin calls, the dealers are caught with unhedged exposures.

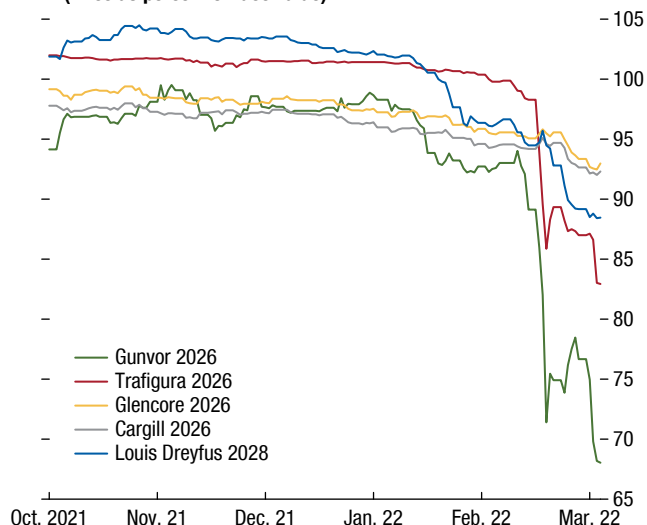
²⁵Initial margins are collateral required to protect a transacting party in the event of default by the other counterparty that could result from a future change in the mark-to-market value. Variation margins are collateral required to protect the party for the current exposure and depend on the mark-to-market value of the derivatives, which can change over time.

Figure 1.16. Commodity Trading Companies Have Been Exposed to a Spike in Volatility

The spike in commodity price volatility ...

1. Commodity Price Change (Percent)

... causes stress for commodity trading companies

2. Bond Performance of Key Energy Commodities Trading Companies (Price as percent of face value)

Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Note: In panel 2, the bond prices of Gunvor, Glencore, and Cargill are quoted in US dollars; the bond prices of Trafigora and Louis Dreyfus are quoted in euros.

the exchanges and central counterparty clearing houses compared to what they collect from clients, adding to banks' liquidity needs.²⁶ More broadly, the danger is that liquidity risk may morph into counterparty credit risk, thus lowering dealers' balance sheet capacity and raising the cost of intermediation across a number of markets.

Another possible pressure point is related to concentration and interconnectedness. The number of dealer banks globally active in commodity markets has declined in recent years. These banks provide credit and liquidity to, among others, a small group of large energy trading firms that operate globally across a number of commodity markets. These firms are largely unregulated, mostly privately owned, and highly reliant on financing by dealer banks to operate. Market participants have also expressed concerns about dealer banks' concentrated positions with respect to assessment of aggregate exposures and risk management practices.²⁷ In addition, available data suggest that investors may be

²⁶At this point, it remains unclear whether these trades are executed over the counter but still centrally cleared, or both executed and cleared over the counter.

²⁷The Division of Trading and Markets of the US Securities and Exchange Commission issued a statement on March 14, 2022, urging broker-dealers and other market participants to remain vigilant regarding market and counterparty risks that may surface during periods of heightened volatility and global uncertainties.

growing concerned about credit availability and liquidity positions of commodity trading firms amid large commodity price moves (Figure 1.16, panels 1 and 2).

Strains in commodity markets may also have adverse effects for end users like commodity producers and consumers, including manufacturers reliant on raw material inputs as well as ultimate consumers. Amid supply chain disruptions and large price swings, banks may become less willing to finance commodity shipments, and the cost of hedging through futures and options may become prohibitively expensive for some producers. In addition, in the event of default on a derivatives contract by a counterparty, smaller clearing members of exchanges may themselves face risk of default, adding strains to the system.

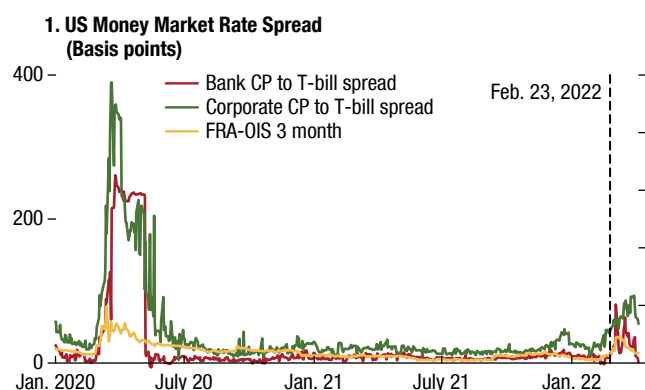
Rising Liquidity and Funding Risks

There are some signs that the sharp rise in market volatility, severe disruptions in commodity markets, and the perception of rising counterparty risk may be starting to weigh on dealer banks' balance sheet capacity and appetite for intermediation, with implications for liquidity and funding conditions as well as broader market functioning.

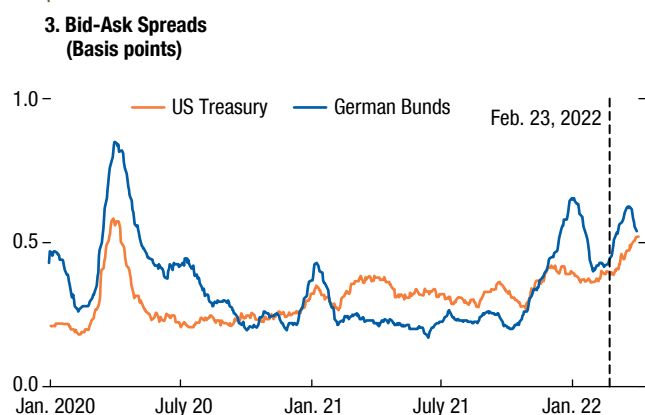
Tensions in short-term dollar funding markets have been limited so far, but strains are beginning

Figure 1.17. Short-Term Dollar Funding Tensions and Market Liquidity

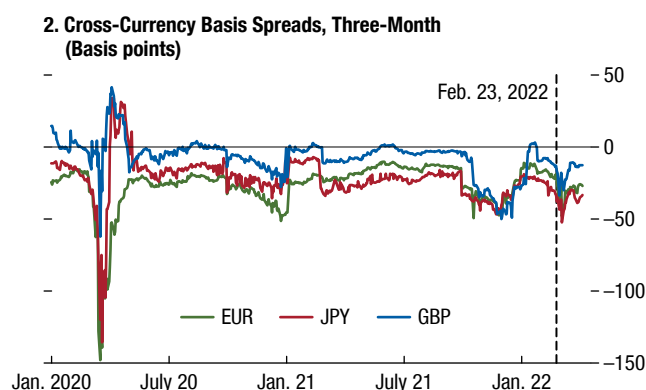
US money market conditions have tightened somewhat ...



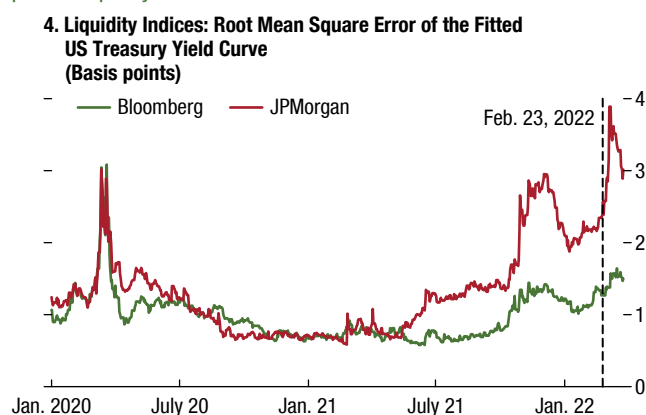
Bid-ask spreads of high-quality government bonds are the widest since the peak of the COVID-19 crisis.



... and international dollar funding conditions have also shown some strains.



Divergence from fair value models reflects traders' unwillingness to provide liquidity.



Sources: Bloomberg Finance L.P.; JPMorgan Chase & Co.; and IMF staff calculations.

Note: In panel 1, commercial papers (CPs) are AA bank 90-day CPs and A2P2 nonfinancial corporate 90-day CPs. The FRA-OIS spread measures the gap between the US 3-month forward rate agreement and the overnight index swap rate. In panel 2, LIBOR-indexed cross-currency basis spreads are used for JPY and GBP prior to February 2021. In panel 4, root mean square error is the measure between fair-value model yields and actual Treasury yields observed. GBP = British pound; EUR = euros; JPY = Japanese yen; T-bill = US Treasury bill.

to emerge. Reportedly reflecting both precautionary motives to bolster liquidity positions as well as growing concerns about credit risk, spreads in short-term dollar funding markets have widened. In US unsecured money markets, LIBOR-OIS and FRA-OIS spreads have widened since the announcement of sanctions,²⁸ but they are still well below levels seen in early 2020. Issuance of financial and nonfinancial commercial paper has risen, leading to increased borrowing costs (Figure 1.17, panel 1). By contrast, secured US money markets (repo) have not displayed signs of stress thus far.

²⁸LIBOR is the London interbank offered rate, OIS stands for overnight index swap, and FRA stands for forward rate agreement.

Similarly, international dollar funding conditions, as measured by the cross-currency swap basis, have tightened since late February, but spreads remain well below pandemic levels (Figure 1.17, panel 2). The actions taken to freeze the Central Bank of Russia's reserves and disconnect a number of Russian banks from SWIFT have also been mentioned as factors contributing to spread widening.²⁹ Amid rising risk aversion and

²⁹Russian banks and the central bank have traditionally been net suppliers to dollar funding markets. However, the impact of the disconnection of Russian banks from SWIFT and freezing of central bank assets on dollar funding markets has been relatively modest thus far. This is mainly due to the large US dollar oversupply in funding markets; other lenders have taken up the slack that the departure of Russian funding created.

strong precautionary demand for high-quality collateral, 10-year euro area swap spreads have widened to levels not seen since 2011.

Despite higher volatility and some strains in funding markets, there are no signs of the “dash-for-cash” dynamics that emerged in March 2020, and the financial system appears more resilient to withstand liquidity and funding shocks. Global liquidity remains at record high levels in advanced economies, and banks are better capitalized and more liquid with a large surplus of reserves. In addition, central banks have tools to alleviate stresses in funding markets. Activation of standing swap lines between central banks and government paper repo lines—the US Federal Reserve’s standing repo facility (SRF) and the Foreign and International Monetary Authorities (FIMA) repo facility, as well as the ECB’s Eurosystem repo facility for central banks—can act as a backstop for dollar (and euro) funding pressures.³⁰ However, the vulnerabilities identified during the COVID-19 pandemic remain largely unaddressed at this point.

Given higher uncertainty and faster Federal Reserve policy tightening, market liquidity conditions of high-quality government bond markets have deteriorated based on multiple metrics. Price-based liquidity metrics, such as bid-ask spreads and fitting errors of yield curve models, have worsened, reflecting market-makers’ unwillingness to hold inventories under a higher volatility environment (Figure 1.17, panels 3 and 4). Further deterioration of market liquidity and functioning could amplify a repricing of duration risk. There also might be a risk of tighter funding conditions due to a close link between market liquidity and funding liquidity (Brunnermeier and Pedersen 2009).³¹

Cyber Risks: A Critical Threat

The war in Ukraine has raised acute concerns about cyber operations. Cyberattacks targeting Ukraine go back several years. In 2017, the NotPetya malware attack originally aimed at critical infrastructure in Ukraine spilled over and caused supply chain disruptions and worldwide losses estimated at about \$10 billion.³²

³⁰The usage of the US Federal Reserve reverse repo facility as of March 25 stood at a level similar to February 23 (\$1.7 trillion).

³¹A decline in market liquidity leads to higher price impact and higher volatility, and a volatility shock may lead to higher haircuts and funding rates. As funding becomes scarce, market makers find it difficult to obtain leverage to finance their inventories. There is a feedback mechanism linking market liquidity and funding liquidity.

³²According to multiple sources, including Wolff (2021).

Cyberattacks intensified in the weeks preceding the current war. The coordination of attacks disrupting banks’ online services with text message (SMS) disinformation campaigns, as observed in Ukraine, increases this risk. Cyberattacks led by private actors have also been reported against Russian institutions, which may further escalate tensions on both sides.

Attacks could target systemically important financial institutions. If successful, such attacks could trigger loss of confidence in the broader financial system, with a potentially adverse impact on global financial stability. Cyber threats against SWIFT and other shared financial and non-financial market infrastructure could also increase. Intense hacktivism and false-flag operations that disguise the actual source of the attack and place responsibility on another party further complicate the situation. As cyber risks rise globally, operational costs have increased across industries, with the potential for significant economic loss in various countries.

The War and a Repricing of Risk in Markets May Put Corporate Sector Recovery at Risk

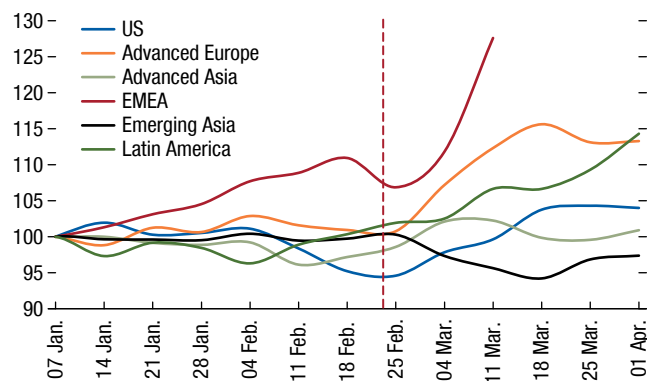
The war in Ukraine has clouded the corporate outlook. Firms most at risk are those in Russia, which will suffer trade barriers, lack of intermediate inputs, and depressed domestic demand. Additionally, more than 60 percent of Russia’s external debt of close to \$500 billion is owed by nonfinancial firms. Elsewhere, the impact of heightened uncertainty, sanctions, and the anticipated slowdown of the economy is evident especially in Europe due to its greater exposure to Russia through trade and investments in energy firms and projects (Figure 1.18, panel 1). European firms have the largest direct exposures to Russia and Ukraine, as measured by revenues from the region (Figure 1.18, panel 2). Sanctions imposed on Russia, the self-imposed exodus of large firms from Russia, and a slump in demand in Russia and Ukraine are expected to result in a sharp decline in global firms’ revenues derived from the region.³³ On a sectoral basis, many large European firms have some exposures to Russia and Ukraine (above 2 percent of revenues from the region). However, the share of debt at firms with

³³“Over 600 Companies Have Withdrawn from Russia - But Some Remain,” Yale School of Management (April 12, 2022). <https://som.yale.edu/story/2022/over-600-companies-have-withdrawn-russia-some-remain>.

Figure 1.18. Corporate Sector amid the War in Ukraine

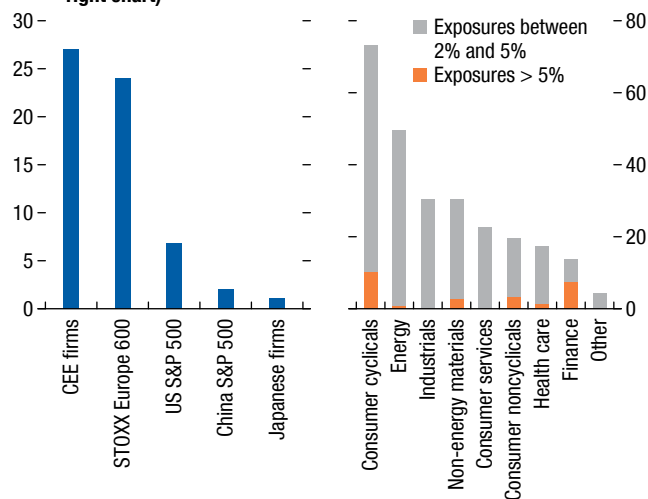
Uncertainty about the corporate sector outlook has increased, especially in Europe.

1. Dispersion in Earnings Forecasts
(Index, January 1, 2022 = 100)



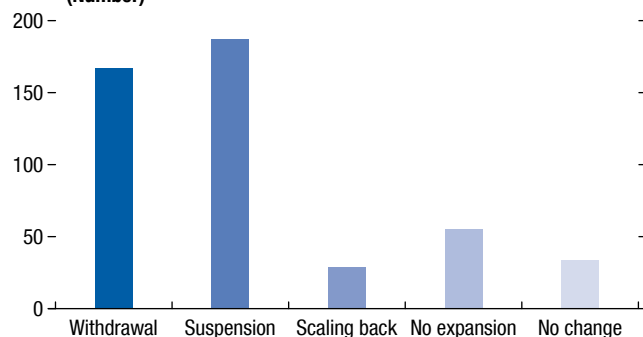
Among international peers, European firms have the largest exposures to Russia and Ukraine.

2. Percent of Firms with Exposures to Russia and Ukraine
(Percent of firms with >2 percent exposures in left chart; share of debt at firms with exposures in total debt of all firms by sector in right chart)



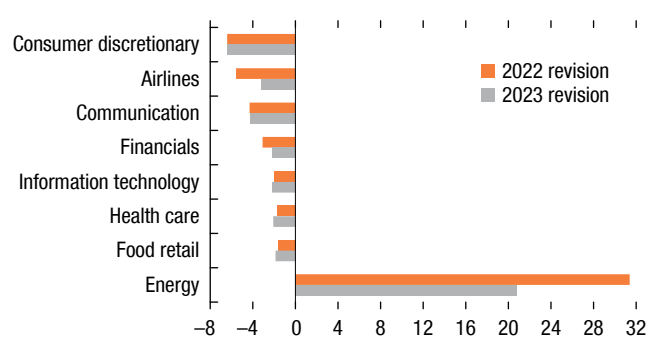
Most large international companies have announced exits of various types from Russia.

3. Number of Large Firms that Have Exited Russia Since Its Invasion of Ukraine
(Number)



Analysts have slashed earnings forecasts across nearly all major sectors.

4. Revisions in Advanced Economy Corporate Earnings Forecasts
(Percent of 2019 earnings, from pre-war period to present)



Sources: Bloomberg Finance L.P.; FactSet; MSCI; Refinitiv Datastream IBES; Yale School of Management; and IMF staff calculations.

Note: Panel 1 presents standard deviations in analyst forecasts of earnings per share over the next 18 months. In panel 2, foreign exposures are defined as revenues derived from abroad in percent of total revenues. In panel 2, the sample includes 529 CEE firms and 2,079 Japanese firms. CEE = central and eastern Europe and includes Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Turkey; EMEA = emerging Europe, Middle East, and Africa.

substantial exposures (above 5 percent of revenues from the region) is less than 10 percent of the total debt of all firms in these sectors. Since the Russian invasion of Ukraine, most large international companies have announced exits of various types from Russia because of the reputational risk and the difficulty of doing business in Russia related to sanctions (Figure 1.18, panel 3).

Global firms have been hit by the rise in energy and raw material prices. In addition, supply chain challenges that have emerged during the pandemic have been exacerbated by the uncertainties and reductions in export quantities of agricultural commodities, energy, metals, and technology inputs affecting a variety of industries. While large firms are generally in a better position to secure shipments of rationed components

and to pass on the increase in input costs to customers because of greater pricing power, even before the war analysts had noted that the pass-through to customers had become more limited and that profit margins were expected to shrink. For example, small European businesses in the transportation and agricultural sectors have already sounded the alarm about energy prices, and over half of US small businesses have voiced concerns about energy prices.

So far, analysts have maintained a positive outlook for most sectors (except airlines), with 2022 earnings projected to be well above pre-pandemic levels. However, analysts have started to substantially downgrade earnings forecasts across sectors, except for energy (Figure 1.18, panel 4). A prolonged war, an escalation of sanctions, higher commodity prices, and increased investor risk aversion could further worsen the corporate outlook. Energy and agricultural product importers in emerging markets and countries with strong trade links with Russia and Ukraine have already seen a more adverse market reaction compared to their peers, based on equity indices and credit spreads. More broadly, increased and lingering uncertainty associated with the war and elevated geopolitical risks are detrimental to corporate investment at a time when it is most needed for the transition to a post-pandemic and greener economy.³⁴ The economic impact of underinvestment could be especially detrimental for vulnerable firms that have already built up debt in the last two years.³⁵ In addition, higher inflation because of rising commodity prices, wage pressures in some regions, tighter financial conditions, and a more cautious lending posture by banks may substantially affect firms' revenues and exacerbate funding challenges for vulnerable businesses, including small and medium-sized firms.

A repricing of risk by investors—due for example to an escalation of the sanctions, a sharper than previously expected tightening of monetary policy, or a deterioration of the economic outlook—could result in a sharp tightening of financial conditions, a development that could interact with unresolved pandemic-related vulnerabilities in the corporate sector. A deterioration in liquidity and funding conditions could be particularly challenging for risky credit markets, an important barometer of risk taking.

³⁴For an overview of the literature on investment under uncertainty, see Dixit and Pindyck (1994).

³⁵See Chapter 2 in the April 2022 *World Economic Outlook*.

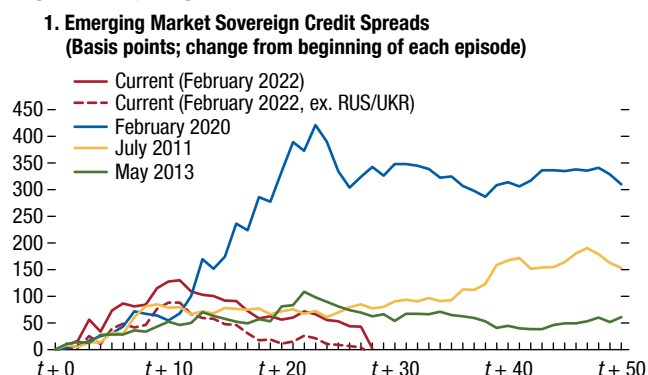
Spreads on high-yield bonds and leveraged loans have widened in advanced economies on the heels of rising market volatility and implications of higher energy and labor costs especially for smaller firms—and are now slightly above pre-pandemic levels. Outflows have accelerated from high-yield bond funds, and new issuance has slowed. Issuance has similarly decelerated in the collateralized loan obligation (CLO) market, as spreads have increased in both secondary market leveraged loans and CLO tranches. Should geopolitical tensions prove longer lasting than currently anticipated and if economic growth were to slow, risky borrowers could face tougher financing conditions and higher rollover risks, potentially resulting in a deeper default cycle that could severely impact the real economy. The tightening in market conditions could be amplified by the deterioration in underwriting standards and first-lien investor protections seen in recent years in both the high-yield bond and leveraged loan market—as reflected by weaker covenants and thinner loss-absorbing buffers for loans. In addition, tighter monetary policy comes in the form of higher interest costs for leveraged loan issuers and could eventually pressure debt servicing capacity.

Emerging Markets Have Come under Pressure, with Notable Differences across Countries

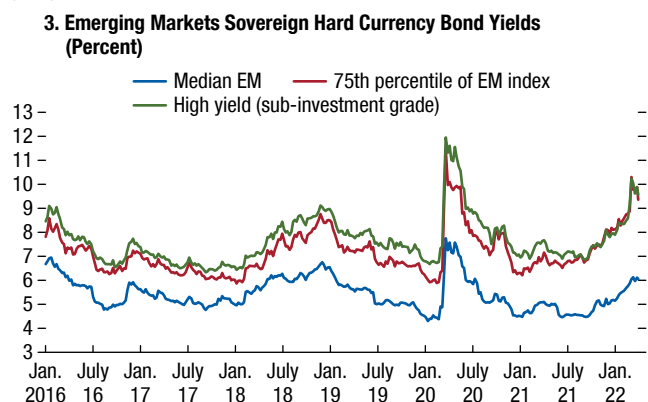
Since the Russian invasion of Ukraine, emerging market hard currency spreads have widened at a rapid pace, akin to earlier episodes of emerging market stress, before retracing part of the move in mid-March (Figure 1.19, panel 1). Credit spreads moved as much as 113 basis points higher—or 84 basis points excluding Russia and Ukraine—after the war in Ukraine started, with a more pronounced widening among high-yield issuers. Weaker issuers were already underperforming before the war as the prospect of monetary policy normalization in the United States was starting to weigh heavily on countries with elevated post-pandemic vulnerabilities. The number of issuers trading at distressed levels has surged higher to nearly 25 percent of issuers (Figure 1.19, panel 2), surpassing pandemic-peak levels. The deterioration in spreads, combined with the increase in US yields, has pushed financing costs well above their pre-pandemic levels for many borrowers (Figure 1.19, panel 3). Emerging market sovereign issuance has been sluggish in recent months, with market access for frontier economies

Figure 1.19. Emerging Market Financial Spillovers

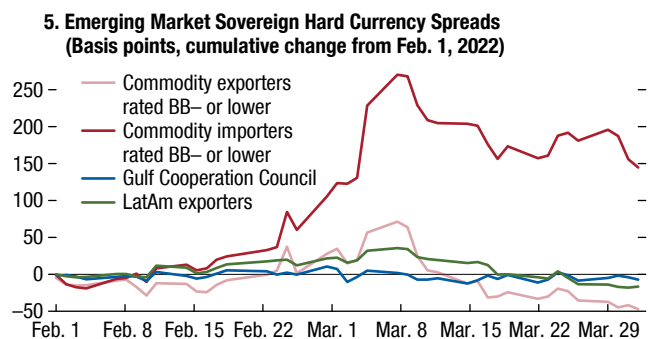
Credit spreads widened sharply as tensions escalated and the war began before pulling back as risk sentiment stabilized.



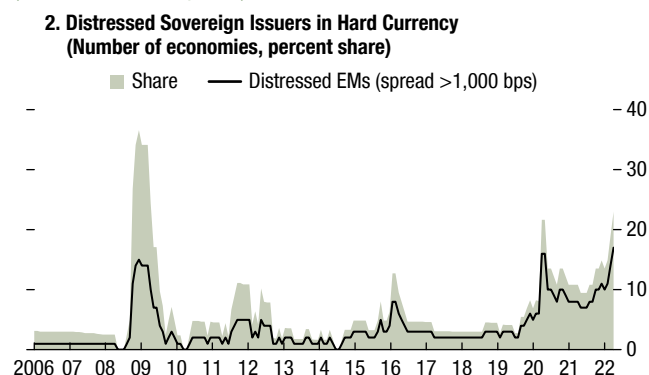
External funding costs for the weakest borrowers have moved above pre-pandemic levels.



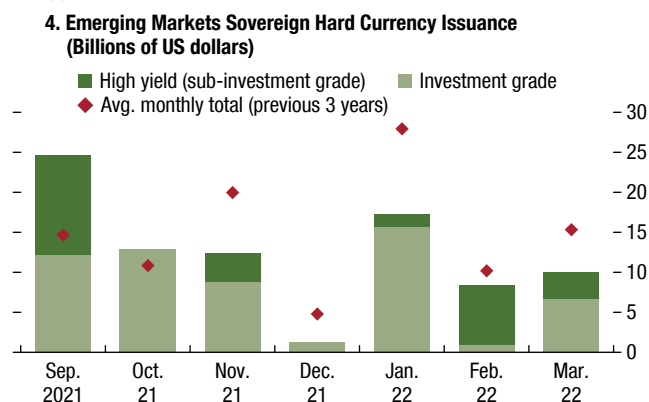
Commodity importers have seen credit spreads widen sharply over a short period.



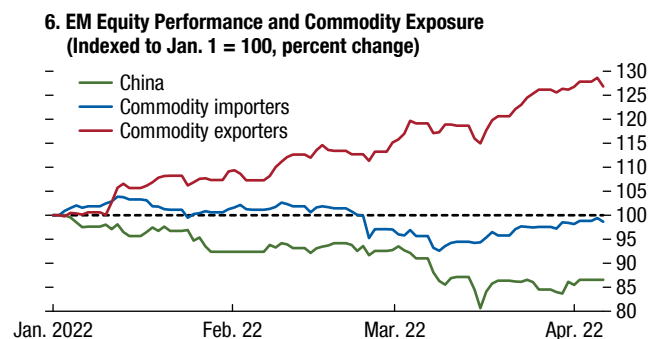
More than 20 percent of issuers have spreads in distressed territory (above 1,000 basis points).



Hard currency issuance has dried up in recent months and practically disappeared since the start of the war.



Equity markets in commodity exporters have outperformed in 2022.



Sources: Bloomberg Finance L.P.; JPMorgan Chase & Co.; UN Comtrade; and IMF staff calculations.

Note: In panel 1, the current episode is the cumulative change since Feb. 18. In panel 4, yields are calculated from JPMorgan Emerging Market Bond Index. In panel 6, net trade balance is based on oil, wheat, and base metals as share of GDP. In panel 5, BB exporters include Angola, Bahrain, Ecuador, Iraq, Nigeria, and Oman. Importers include the Dominican Republic, Egypt, Georgia, Jordan, Kenya, Pakistan, Senegal, and Tunisia. EM = emerging market; LatAm = Latin America; RUS = Russia; UKR = Ukraine.

in particular deteriorating. The share of high-yield issuance had dropped notably since the third quarter of 2021, including a nearly four-week freeze following the escalation of hostilities. Nigeria and Turkey reopened the market on March 17, 2022, after risk sentiment had improved, albeit with a substantial premium over their existing benchmarks and coupons over 8 percent (Figure 1.19, panel 4).³⁶

Commodity exposures and trade linkages to Russia and Ukraine have been a key source of differentiation in terms of market performance. The role of Russia and Ukraine in energy, metals, agriculture, and tourism has exposed several emerging markets to a large deterioration in their terms of trade, upside risks to inflation, and increased pressures on fiscal accounts given food and energy subsidy policies. Flight-to-quality dynamics, as well as investor preference toward countries that are set to benefit from the rise in commodities, have led to a general outperformance of higher-rated commodity exporters, both in credit and equity markets (Figure 1.19, panels 5 and 6). The differentiation is also notable among lower-rated issuers, where spreads have widened significantly for some commodity importers.

Portfolio Flows Have Come under Pressure, with High Differentiation across Economies and Risks Tilted to the Downside

After a challenging end to 2021 for portfolio flows, flows into emerging market local currency debt and equity markets strengthened in early 2022, defying expectations of policy normalization in the United States. Fund inflows were stronger for countries in Asia, eastern Europe, and the Middle East and North Africa, reflecting subsiding concerns about the pandemic, and in some cases rising commodity prices (Figure 1.20, panel 1). Moreover, hiking cycles were already much farther along in many emerging markets, creating attractive risk compensation (carry) for investors in both real and nominal terms when compared to advanced economies. Finally, the potential for large outflows was seen as low, as the nonresident investor base had been considerably reduced in preceding years (Figure 1.20, panel 2).

³⁶Frontier markets include 42 countries, incorporating 31 countries from the JP Morgan Next Generation Markets Index.

However, following the Russian invasion of Ukraine, flows become highly volatile and reversed quickly for some economies. Flows in local currency bonds and equities have come under pressure, experiencing the largest weekly redemptions since March 2020. The first signs of differentiation across countries have emerged (Figure 1.20, panel 3). Economies benefiting from higher commodity prices, such as Brazil and Indonesia, withstood the pressure and have seen large equity inflows on net so far this year, while some energy importers have seen sharp equity outflows. Some of the outflows in more liquid markets like Chinese sovereign bonds (which saw the largest monthly outflow on record in February) in part reflect technical factors, as fund managers have reportedly raised cash holdings in expectation of possible redemption pressure. The need for short-term liquidity was further amplified by the highly illiquid market conditions in Russian markets due to sanctions and trading restrictions.

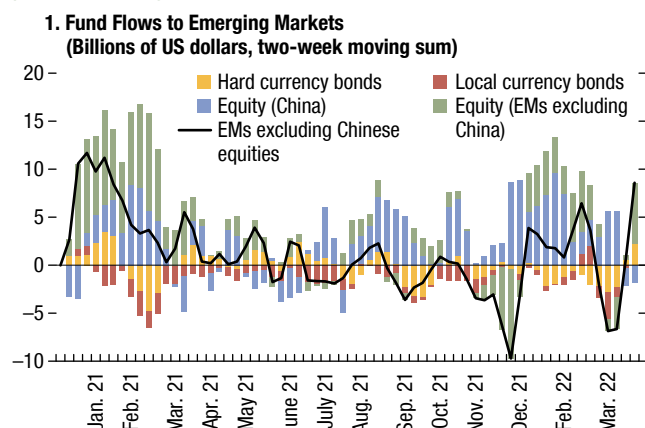
Looking ahead, the interplay of tighter external financial conditions on the back of monetary policy normalization in the United States and heightened geopolitical uncertainty is likely to increase the downside risks for portfolio flows. IMF staff analysis shows that capital flows at risk (the 5th percentile of the range of capital flow forecasts to quantify the downside risks; see IMF 2019 for more details) have increased to 2.3 percent of GDP from 1.7 percent of GDP in the October 2021 GFSR, and the probability of outflows is about 30 percent from 20 percent from the October 2021 GFSR. A sharp rise of US term premia, combined with a further rise in risk aversion, would entail more significant financing risks for emerging market economies. In such a scenario, these economies would be subject to much stronger headwinds, especially countries with lingering inflation risks and/or elevated debt vulnerabilities. For example, a risk aversion shock similar to the one seen in March 2020 would take capital flows at risk to 2.5 percent and increase the probability of outflows to almost 50 percent (Figure 1.20, panel 4).

Risks of Cryptoization and Sanction Evasion through the Crypto Ecosystem

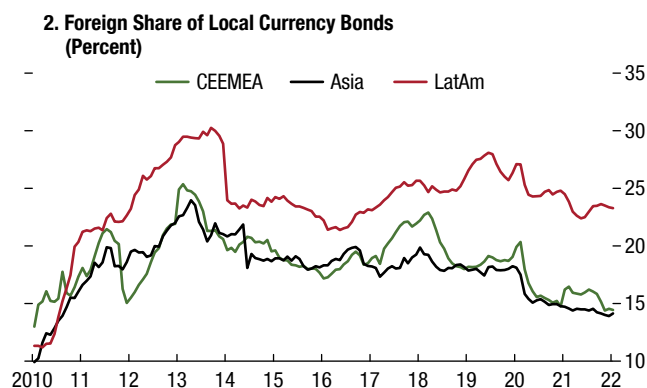
Crypto asset trading volumes against some emerging market currencies have increased notably since the start of the pandemic. Although a large part of this increase is due to speculative investment activities by emerging

Figure 1.20. Emerging Market Portfolio Flow Pressures Have Intensified

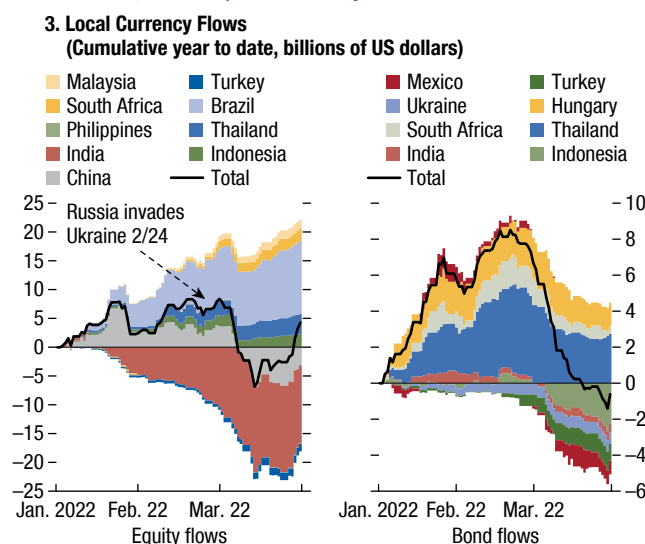
Portfolio flows recovered in early 2022 but have come under renewed pressure recently.



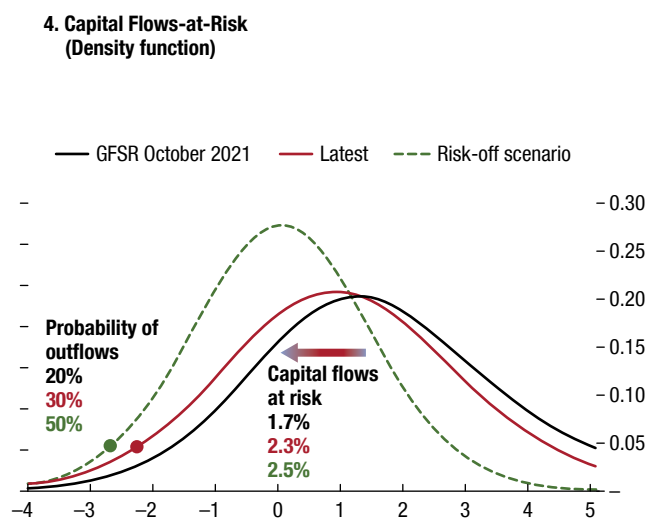
Foreign holdings of local currency debt have been close to multiyear lows for several issuers.



Local currency outflows declined sharply, with significant differentiation, before a partial recovery in late March.



Capital flows-at-risk worsened significantly as a result of the decline in investor risk sentiment.



Sources: Bloomberg Finance L.P.; JPMorgan Chase & Co.; national data sources; and IMF staff calculations.

Note: In panel 3, total equity flows include Vietnam, Sri Lanka, and United Arab Emirates, which are not shown. In panel 4, the risk-off scenario assumes a global risk aversion shock with Chicago Board Options Exchange Volatility Index reaching the March 2020 peak levels. CEEMEA = Central and Eastern Europe, Middle East, and Africa; EMs = emerging markets; GFSR = *Global Financial Stability Report*; LatAm = Latin America.

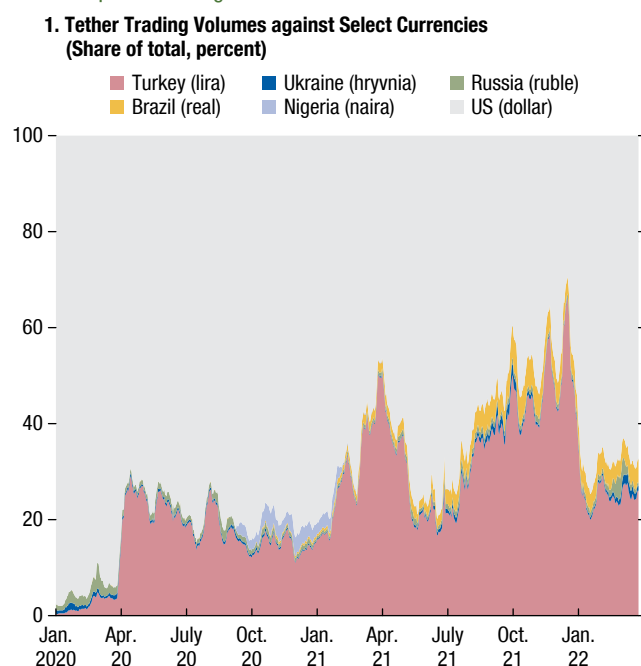
market residents, a more structural shift toward crypto assets as a means of payment and/or store of value could pose significant challenges to policymakers (see the October 2021 GFSR for a discussion on cryptoization). For example, Tether—the largest stablecoin used to settle spot and derivative trades—has seen a notable rise in trading volumes against emerging market currencies (Figure 1.21, panel 1). The most pronounced increase is in Turkey, where exchange rate

volatility has been particularly high, and the overall use of crypto assets appears to have gained traction over the last few years. More recently, trading volumes spiked following the introduction of sanctions against Russia and the use of capital restrictions in Russia and Ukraine (Figure 1.21, panel 2).³⁷ However, liquidity

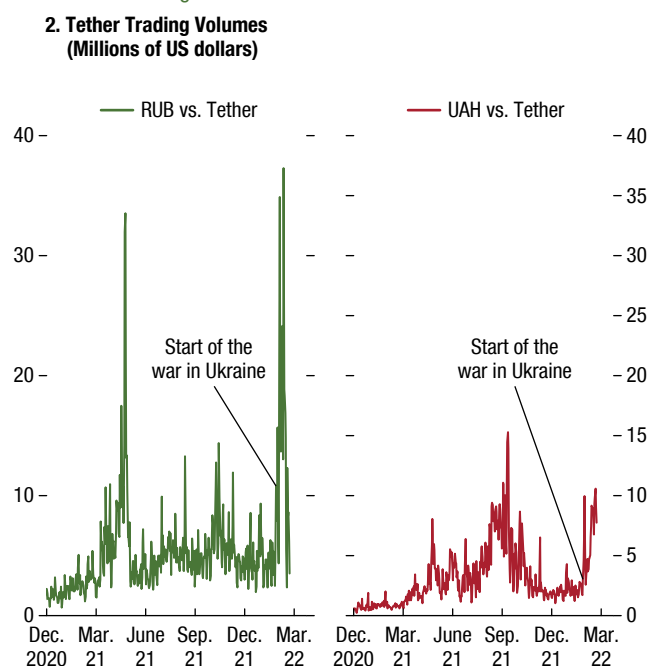
³⁷The spike in trading preceded Ukraine's enactment of the Law on Virtual Assets (March 17, 2022), which legalized crypto assets.

Figure 1.21. Crypto Asset Markets

The share of Tether volumes against EM currencies has been rising since the pandemic began.



The ruble and hryvnia have seen a spike in crypto trading volumes in centralized exchanges.



Sources: Bloomberg Finance L.P., CryptoCompare; and IMF staff calculations.

Note: AE = advanced economies; EM = emerging markets; RUB = Russian ruble; UAH = Ukrainian hryvnia.

in the ruble and hryvnia trading pairs in centralized exchanges remains limited and has even declined more recently in the case of ruble,³⁸ making large-scale transfers of value through crypto asset exchanges impractical.

The war in Ukraine has brought to the forefront some of the challenges that regulators face in terms of applying sanctions and capital flow management measures. Crucially, the implementation of such measures requires that intermediaries verify the identities of the transacting parties. The crypto ecosystem, however, could allow users to circumvent such requirements through several means, including (1) the use of exchanges and other crypto asset providers that are non-compliant with sanctions and/or capital flow management measures; (2) poor implementation of adequate due diligence procedures by crypto asset providers; and (3) the use of technologies and platforms that increase

the anonymity of transactions (such as mixers, decentralized exchanges, and privacy coins).³⁹ Regulators in the United States and United Kingdom, among others, have urged firms in their jurisdictions, including the crypto asset sector, to increase vigilance with regard to potential Russian sanction evasion attempts.⁴⁰

Over time, sanctioned countries could also allocate more resources toward evading sanctions through mining. Mining for energy-intensive blockchains like Bitcoin can allow countries to monetize energy resources, some of which cannot be exported due to sanctions. The monetization happens directly on blockchains and outside the financial system where the sanctions are implemented. Miners can also generate

³⁸Major exchanges have frozen the accounts of sanctioned entities, while new ruble deposits in exchanges may have been blocked (see Binance 2022). As a result, part of the transaction volumes could have shifted to less transparent peer-to-peer platforms.

³⁹Chainalysis (2022) has reviewed several potential sanction evasion mechanisms since the start of the war. None of the indicators showed a sustained spike in volumes at the time of writing.

⁴⁰For the United States, see “FinCEN Advises Increased Vigilance for Potential Russian Sanctions Evasion Attempts,” U.S. Financial Crimes Enforcement Network Fin-2022-Alert001 (March 7, 2022); for the United Kingdom, see the “Joint Statement from UK Financial Regulatory Authorities on Sanctions and the Cryptoasset Sector,” Financial Conduct Authority (November 2, 2021).

revenues directly from users that pay transaction fees to miners (which in this case might be sanctioned governments). At this point, the share of mining in countries under sanctions and the overall size of mining revenues suggests that the magnitude of such flows is relatively contained, although risks to financial integrity remain. For example, the monthly average of all Bitcoin mining revenues last year was about \$1.4 billion, of which Russian miners could have captured close to 11 percent, and Iranian miners, 3 percent.⁴¹

Financial Vulnerabilities Remain Elevated in China amid Ongoing Stress in the Property Development Sector and COVID-19 Risks

Concerns about a sharper-than-anticipated growth deceleration in China amid elevated financial vulnerabilities have weighed on the global economic outlook. Chinese equity prices have slumped, particularly in the tech sector, amid new outbreaks of COVID-19 and worsening investor sentiment, in part reflecting the impact of continued regulatory uncertainty and rising geopolitical risks. Financial stability risks have risen amid ongoing stress in the battered real estate sector, a major source of China's economic growth and household wealth in the past decade. Severe financing strains have spread through much of the property development sector, generating spillovers to housing sales, real estate investment, and land sales. Widening mobility restrictions aimed at containing COVID-19 outbreaks could delay recovery in the property market and pose further disruptions to spending and income. Exceptional financial support measures may be necessary to ease balance sheet pressures but would add further to medium-term debt vulnerabilities.

Credit availability has deteriorated for some corporate borrowers, notably home builders, whose offshore US dollar bonds have slumped by more than 50 percent since the second half of 2021.⁴² Amid property market pressures and signs of slowing growth, Chinese authorities have taken steps to ease property sector financing controls, lower policy interest rates, and increase fiscal spending. Authorities have also pledged to stabilize financial markets and reduce regulatory uncertainty for tech firms, supporting investor sentiment.

⁴¹These figures are as of August 2021 and are based on the Cambridge Bitcoin Electricity Consumption index.

⁴²Property developers have nearly \$215 billion in debt outstanding in offshore US dollar bond markets.

Financial stress in the developer sector has nevertheless worsened amid evidence of self-reinforcing pressures on liquidity, creating risks of broader spillovers to the housing market, financial sector, and the real economy. Property developers have relied heavily on presales of unfinished properties as a key source of funding. Amid concerns that developer balance sheet problems may affect their capacity to finish presold homes, home purchases have slowed sharply, and local governments have tightened escrow requirements to ensure sufficient funds to complete local projects. These factors have exacerbated the large liquidity gap created by contractual spending commitments, which had typically been covered by additional borrowing and new presales (Figure 1.22, panel 1). These liquidity pressures, along with news that many developers carried substantial hidden debts or guarantee obligations on top of their already thinning equity buffers, have reinforced a sharp tightening in credit availability for the sector.

Disruptions to the completion of presold housing could reinforce market pressures on real estate firms and the broader housing market. Property developers' large stock of presold but unfinished housing has grown rapidly and is nearly equivalent to the size of all private housing completed since 2015 (Figure 1.22, panel 2, left side). Financial statements show that nearly half of presale liabilities are owed by "developers-at-risk," defined as those with liquidity shortfalls (Figure 1.22, panel 2, right side, sum of orange and gray bars).⁴³ Unfinished housing projects could affect property prices for adjacent developments and weigh on valuations of property developers' inventories, raising solvency concerns.

Financial strains in the property development sector could create several mutually reinforcing channels of macro-financial stress.⁴⁴ First, prolonged dislocations in new home sales could trigger a correction in property prices due to high valuations and oversupply in some cities. Prices appear stretched across the country.⁴⁵ Inventory overhangs are also significant in some of China's smaller Tier 2 cities outside the eastern

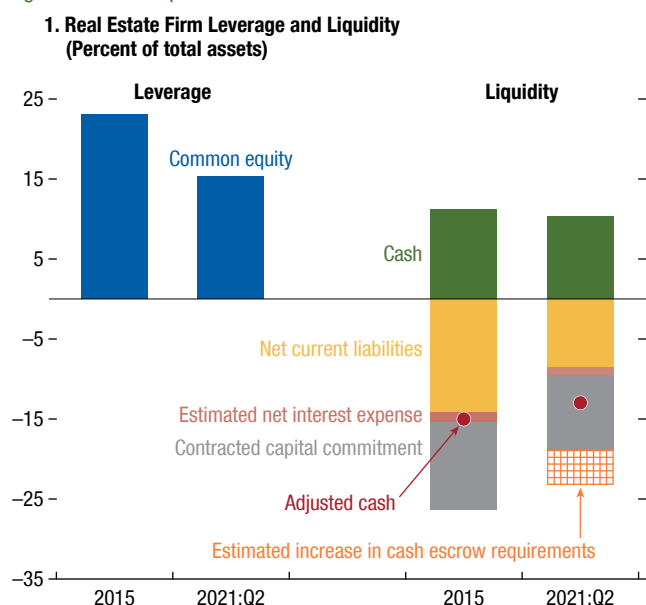
⁴³Liquidity shortfalls are defined as cash being less than combined net current liabilities, net interest payment, and contractual capital commitments.

⁴⁴Worsening property sector stress could create international spillovers, see IMF (2022, Box 4).

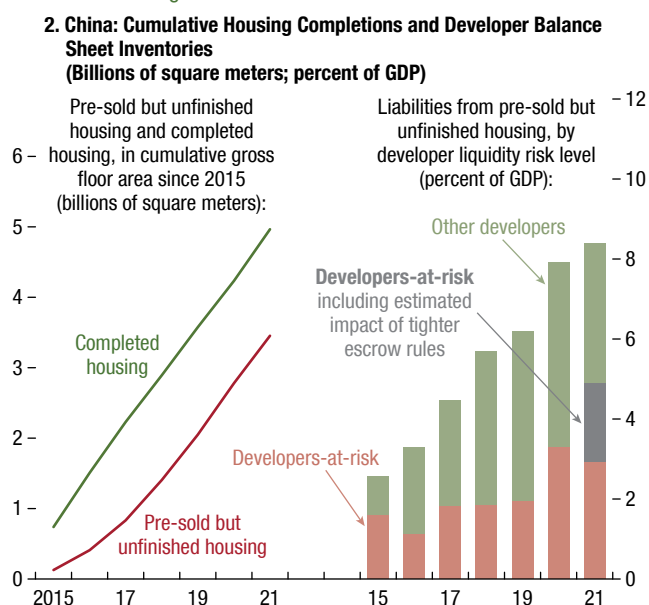
⁴⁵Price-to-income ratios in China's smaller and less developed Tier 2 and Tier 3 cities are about twice those of the five largest advanced economy cities, and those in China's larger and wealthier Tier 1 cities are closer to four times higher.

Figure 1.22. Stress in the Chinese Property Development Sector

Credit contagion reflects leverage concerns and liquidity shocks from tighter escrow requirements.



Liquidity stress may affect completion of a large stock of pre-sold but unfinished housing.



Sources: Bloomberg Finance L.P.; CEIC; S&P Capital IQ; and IMF staff calculations.

Note: In panel 1, the estimated increase in cash escrow requirements is calculated as the lesser of 20 percent of unearned revenues or 40 percent of unearned revenues less restricted cash. In panel 2, developers considered at risk have insufficient cash to cover net current liabilities (including net interest payments and contracted capital commitments) or net current liabilities and an estimated increase in cash escrow requirements as calculated in panel 1. Data for 2021 are from end-June.

provinces and in less developed Tier 3 cities. Large declines in house prices could also reinforce tightening financial conditions through balance sheet channels, as a large share of loans are collateralized by real estate assets.

Second, property developers' financial strains are likely to add to the fiscal pressures of local governments, constraining financing conditions for some vulnerable firms dependent on local authorities' support. Provincial or city authorities may have to pick up the cost of completing unfinished housing projects to avoid further destabilizing homebuyer confidence in housing markets. Land sales, which account for a sizable share of local governments' gross funding, are also falling sharply as liquidity-strapped property developers pull back on purchases. In provinces with weak public finances, deepening investor concerns about the credibility of local governments' backstops for local firms could exacerbate an existing pullback in corporate credit availability (Figure 1.23, panel 1) or precipitate the default of a local government financing vehicle (see the October 2021 GFSR).

Finally, rising defaults by property developers could impair balance sheets across the broader private sector, weighing on credit intermediation and aggregate

demand. Aggregated total liabilities of property developers with publicly available data are nearly 25 percent of GDP, with roughly half of that attributable to those with liquidity shortfalls (defined as "liabilities-at-risk"). Roughly half of these liabilities-at-risk, or about 6 percent of GDP, are owed to business partners and homebuyers, with the other half owed to financial institutions (Figure 1.23, panel 2). Rising balance sheet stress across banks and private borrowers alike could limit banks' capacity and willingness to extend new credit, weakening growth momentum. As property developers' liquidity worsens, mortgage credit availability could also suffer as banks rely on property developers' guarantees to provide mortgages against presold homes.

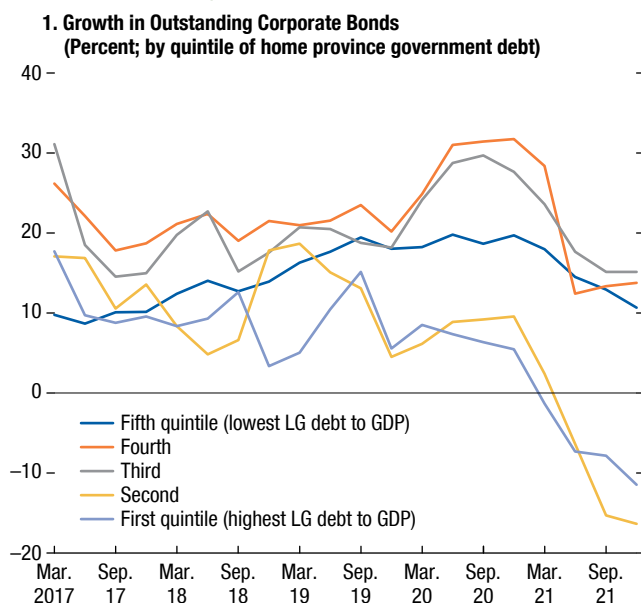
Selected Medium-Term Structural Challenges Policymakers Will Need to Confront

Could the Geopolitics of Energy Security Put the Energy Transition and thus Financial Stability at Risk?

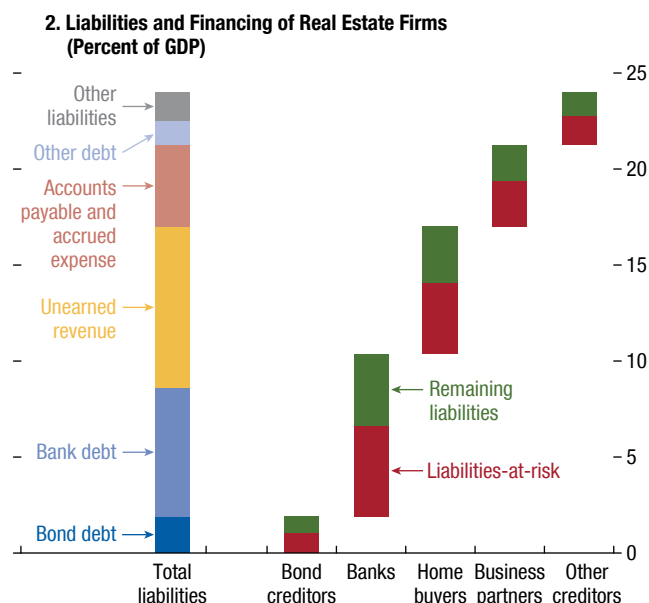
The Russian invasion of Ukraine, the ensuing sanctions, and the actions of market participants in response to a global outcry have wreaked havoc in

Figure 1.23. Chinese Property Development Spillovers

Rising macro-fiscal pressures may exacerbate challenging credit conditions for firms in provinces with heavier debt loads.



Rising defaults could spill over to bank loan books and other private sector balance sheets.



Sources: Bloomberg Finance L.P.; CEIC; S&P Capital IQ; WIND Information Co.; and IMF staff calculations.

Note: In panel 2, data are from mid-2021 or latest available. Banks' exposures to real estate firms include their direct lending to real estate firms and their mortgage lending to homebuyers; the latter, which is guaranteed by real estate firms, is for financing unfinished, presold housing. LG = local government.

commodity markets. Disruptions in supply chains, rising concerns about counterparty risk, and growing worries about energy availability have pushed commodity prices higher across the entire complex (Figure 1.2). Given Russia's large footprint in global commodity production, not only oil and gas prices, but also widely used metals (including those used for renewables), have increased sharply (Figure 1.24, panel 1).

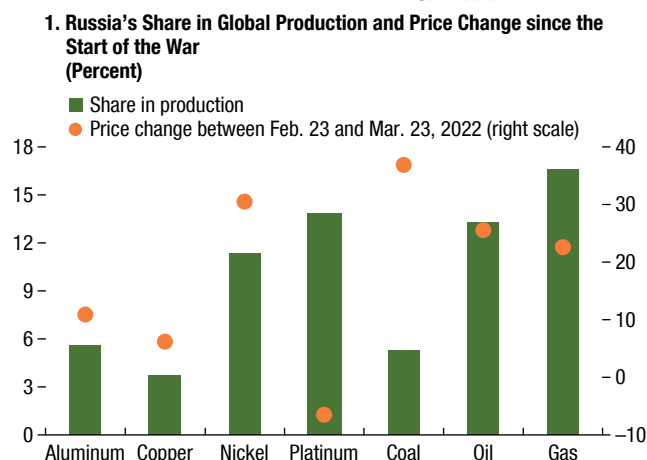
Against this backdrop, the war in Ukraine has crystallized concerns about energy security across the globe. With the perception of the trade-off between energy security and transition changing rapidly, there is a risk that the transition toward renewables may become more costly, complex, and disorderly. Given that climate change poses a threat to financial stability, a delayed and disorderly climate transition may magnify risks to the financial system. There may be some setbacks in the immediate future, but the impetus to reduce energy dependency on Russia could be a catalyst for change. It is therefore crucial that policy-makers intensify their efforts to achieve net-zero targets and lever up private finance to accelerate the transition toward a greener economy.

The war has indeed made evident the energy dependency of Europe on Russia. In particular, Europe relies on Russia for roughly 40 percent of its consumption of natural gas and for more than 50 percent of thermal coal, (Figure 1.24, panel 2). Renewable energy currently accounts for only 22 percent of energy consumption in Europe. In response to the war, Europe is rethinking its energy landscape (for example, through the REPower EU agenda).⁴⁶ However, uncertainties remain in the short term. Physical bottlenecks are significant, for example in the context of switching to coal-fired power generation. In addition, Europe's diversification strategy (with increased

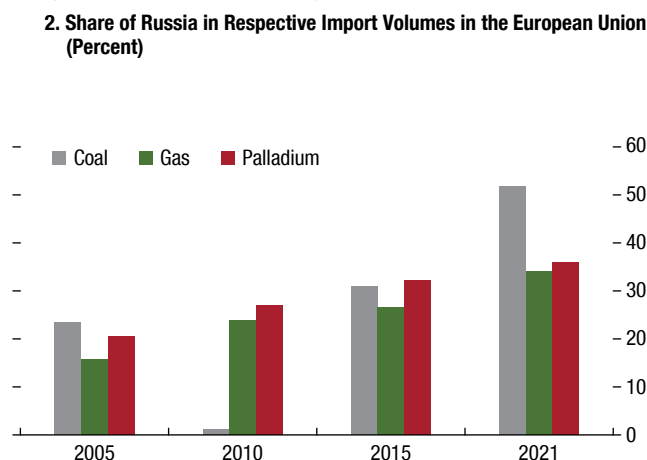
⁴⁶REPower EU is a multifaceted plan announced in early March 2022 by the European Commission that aims to reduce gas imports from Russia by almost 70 percent by the end of this year, refilling gas storage, increasing investment in regasification terminals, and speeding up the transition with supply- and demand-driven measures. The statement by the European Commission and the United States on energy security, published on March 25, 2022, which builds on the REPower EU agenda, aims at terminating EU dependency on Russian gas by 2027. Germany's Federal Ministry for Economic Affairs and Climate Action on March 25, 2022 also announced plans to fully move away from Russian gas imports by the end of 2024.

Figure 1.24. The War in Ukraine Tests the Climate Challenge

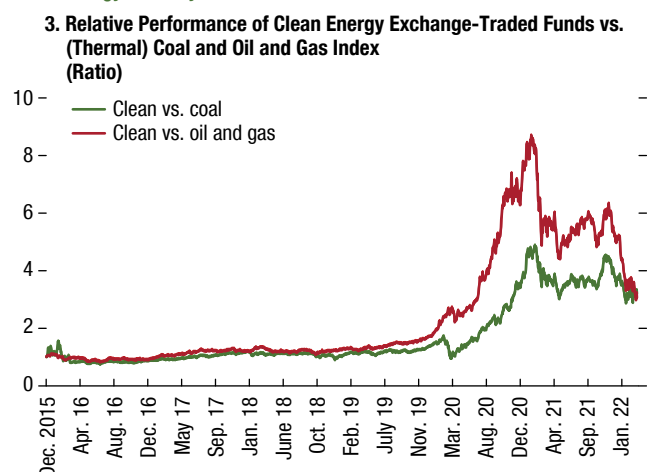
Commodity prices have jumped across the entire complex given Russia's substantial share of the world's energy supply ...



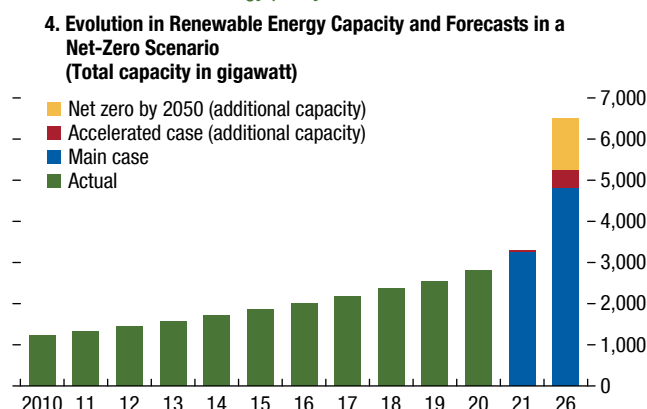
... leading to decisive trade-offs in the short to medium term due to Europe's reliance on Russia for key commodities.



Recent outperformance by renewable energy indices has deteriorated amid energy security concerns ...



... as Europe's reliance on Russia for key commodities is leading to decisive trade-offs in energy policy in the short to medium term.



Sources: Bloomberg Finance L.P.; BP Statistical Review of World Energy; International Energy Agency; UN Comtrade; US Geological Survey, National Minerals Information Center; and IMF staff calculations.

Note: In panel 4, IEA's forecasts are shown for 2026, where main case is the base case scenario, accelerated case is a more optimistic scenario, and Net-zero by 2050 case estimates capacity needed to transition to a net-zero energy system by 2050.

imports from the Asia, Australia, and the United States) is likely to take time to be fully implemented amid rising global energy demand (especially in Asia) and supply constraints.

The war has also made evident the urgency to cut dependency on carbon-intensive energy and accelerate the transition to renewables. However, the energy transition strategy may face setbacks for some time. Some countries have already indicated their intention to switch to domestic coal-fired power generation and fossil fuel production to secure

their energy needs in the short term. Moreover, the current energy crisis is likely to weigh on the speed of phasing out fossil fuel subsidies in emerging market and developing economies and could also delay the decommissioning plans for coal-fired power plants—especially in major coal-exporting countries (Australia, Indonesia, South Africa, United States). Rising inflation pressure may also lead authorities to resort to subsidies or other forms of fiscal support to households or firms, with the risk of delaying climate transition plans.

In addition, the buildup of renewable energy infrastructure will require time and is likely to face headwinds amid rising prices and supply disruptions of critical commodities (such as cobalt, palladium, and nickel). As an indication of possible headwinds, the increased focus on energy security appears to have adversely affected the performance of clean energy indices relative to fossil fuels. This weaker performance has occurred despite strong investor demand for low-carbon assets and a substantial decline in renewable energy costs in recent years (Figure 1.24, panel 3). Meanwhile, renewable energy supply remains limited amid a shortfall in renewable energy investment, (Figure 1.24, panel 4).

The most recent Intergovernmental Panel on Climate Change report has highlighted that fossil-fuel burning is “choking humanity,” enhancing the urgency of the energy transition to avoid carbon lock-in in infrastructure and policy, and therefore irreparable damage to our planet. Meanwhile, the war in Ukraine has brought to fore the need to ensure energy security and the mitigation of supply vulnerabilities in a world where the geopolitical landscape is rapidly changing. Policymakers need to strike the appropriate balance to achieve fundamental objectives that may at times seem difficult to reconcile.

As the Line between Geopolitics and Financial Markets Gets Blurred, New Challenges Arise

The swift imposition of sanctions and the immobilization of the assets of the Central Bank of Russia have raised a number of issues that policymakers must confront. One key issue is whether the composition of exchange rate reserves will change. Some market commentators have argued that reserve managers may opt to diversify away from currencies of advanced economies and the US dollar in particular. Potential beneficiaries of such a shift may be assets that the Group of Seven (G7) will find more difficult to immobilize if there are new geopolitical events, including the Chinese renminbi, commodities, and potentially even crypto assets.

For now, such a scenario appears distant. The composition of currencies held by central banks has remained largely steady over decades. Reserve compositional changes can be described as glacial in pace even considering the small decline of the US dollar share over the years (Iancu and others 2020). In the

medium to long term, however, geopolitical shifts and technological changes can indeed cause central banks to rethink what constitutes, and how to hold, reserves. Emerging market and developing economies could also issue more debt in the currencies of emerging creditors, such as China, to help meet increased financing needs. Countries may become more interested in ensuring critical supplies that could alter trade links and invoicing practices. In addition, a shift toward localized production would reduce the demand for international currencies. Finally, demand for alternative reserve currencies may increase in some regions. Issuers of alternative reserve currencies could increase the attractiveness of their currencies through leveraging digital technology, which could help them overcome some of the advantages of incumbent currencies.

There are strong welfare effects of sharing common payment infrastructures or critical service providers, although risks of single points of failure must also be managed in order to uphold operational resilience. Costs can be shared, and economies of scale applied. Likewise, such sharing increases compatibility between domestic payment systems, which facilitates international trade and finance. There is a risk that measures to increase a country’s resilience to sanctions could promote the development of parallel national or regional infrastructures or critical service providers. For instance, there are currently only a few international payment message providers other than SWIFT, but these are generally small and cover a limited geographical area. Users of the Chinese payment system CIPS, for instance, currently still rely partly on SWIFT. An increased ambition to allow for payment messaging outside of SWIFT could, however, lead to establishing larger and fully independent and parallel systems. Consequent loss of efficiency and cross-border payment compatibility could also undermine efforts to improve access globally to cheap, safe, and efficient cross-border payments. In particular, there is ongoing international collaboration to increase compatibility and improve cross-border payments undertaken under the aegis of the Group of Twenty (G20) (FSB 2020).

This fragmentation could also arise in emerging payment infrastructures. Many countries are currently exploring central bank digital currencies (CBDCs) and are also looking into their use for cross-border payments. Within the G20 initiative to enhance cross-border payments there is a workstream on how CBDCs could improve cross-border

payments and increase global economic integration. Efforts to increase resilience to sanctions could undermine this project, and instead lead to fragmentation as national central banks seek to establish CBDCs independent of international infrastructures. There is a risk of competing “CBDC blocs” with fragmentation across technology and design. Cross-border compatibility could work well within the bloc but have little or no compatibility with CBDCs outside of each bloc.

Finally, the imposition of unprecedented financial sanctions could also lead to more complex, bespoke, and less passive asset allocation on behalf of investors. For example, going forward investors could place greater importance in their portfolio decisions on some of the risk factors exposed by the war in Ukraine (such as currency convertibility, sanctions, and reputation risk) and less importance on the decisions of benchmark providers. Analysts have also noted the possibility of creating bespoke indices that could cater to the unique mandates of different investors. In such a scenario, markets that have a higher share of benchmark-driven investors, including some frontier economies (IMF 2019), could be especially at risk of losing portfolio inflows.

Policy Recommendations

Central banks face a challenging trade-off between fighting persistent inflation and safeguarding the recovery at a time of heightened uncertainty about the global economic outlook while avoiding a disorderly tightening of global financial conditions. Higher policy interest rates and the unwinding of pandemic-related balance sheet policies will eventually lead to tighter financial conditions. Such a tightening is, in fact, an intended objective of policy, necessary to slow aggregate demand. With inflation expected to remain stubbornly high and significantly above target in many advanced economies, central banks should act decisively to prevent inflation pressure from becoming entrenched and avoid an unmooring of inflation expectations. As the war in Ukraine continues to unfold, the surge in commodity prices and disruptions to global supply chains pose further upside risks to the inflation outlook. Amid tight labor markets and still robust demand, there is a risk that wage and price increases may become entrenched. Against this backdrop, central banks in advanced economies will need to normalize the monetary policy

stance at a faster pace than was anticipated only a few months ago to bring inflation credibly back to target.

Policymakers should provide clear guidance about the policy normalization process while remaining data dependent. Amid persistent inflation pressure, central banks face challenges to meet their mandates and should be resolute in preventing any perceived damage to their credibility. To avoid unnecessary volatility in financial markets, it is crucial that central banks in advanced economies provide clear guidance about the normalization process. Such guidance should include both the expected path of policy rates and the anticipated unwinding of pandemic-related asset purchases. With significant accommodation still in place (as evidenced by still meaningfully negative real rates in many advanced economies), policymakers may consider a faster pace of balance sheet normalization to achieve the desired tightening of financial conditions. Finally, it is also important that the normalization process remain data-dependent and be recalibrated along the way as dictated by the evolution of the economic and inflation outlook as well as by market conditions that are already affected by the war in Ukraine.

Emerging market economies remain vulnerable to a tightening of global financial conditions. While there is still heterogeneity across emerging markets in terms of the inflation outlook and policy responses, many central banks have already significantly tightened policy, most notably in Latin America and eastern Europe. Further rate increases, or policy normalization with respect to other measures such as asset purchases, should continue as warranted based on country-specific inflation and economic outlooks and the persistence of commodity price increases to anchor inflation expectations and preserve policy credibility. In countries where inflation has surprised on the upside and there are tangible risks of more persistent price pressures that put central bank credibility at risk, a more frontloaded and decisive monetary policy response is needed. An abrupt and rapid increase in US rates could lead to significant spillovers to some emerging and frontier markets, adversely affecting the recovery and further widening the gap with advanced economies. A disorderly tightening of global financial conditions would be particularly challenging for countries with high financial vulnerabilities, unresolved pandemic-related challenges, and significant external financing needs.

Policymakers should take targeted actions to contain the buildup of financial vulnerabilities during the policy

normalization process. This includes tightening selected macroprudential tools to tackle pockets of elevated vulnerabilities while avoiding a disorderly tightening of financial conditions. If such tools are not available—for example, in the nonbank financial intermediation sector—policymakers should urgently develop them. Striking a balance between containing the buildup of vulnerabilities and avoiding procyclicality appears important in light of persisting uncertainties about the economic outlook owing to the war in Ukraine, the ongoing monetary policy normalization process, and limits on fiscal space in the aftermath of the COVID-19 pandemic.

On the fiscal front, amid heightened uncertainty and marked divergence across countries, tailored and agile fiscal policy response to an evolving situation is warranted (see the April 2022 *Fiscal Monitor*). In those economies hardest hit by the war, fiscal policy will need to address the humanitarian crisis and economic disruption. Given rising inflation and interest rates, fiscal support should be targeted to those most affected and to priority areas. In many emerging markets and low-income economies, higher inflation and tightening global financial conditions call for prudence, while fiscal support is needed for those that will be the hardest hit by the higher commodity prices and where the recovery was already weaker. To help alleviate the burden of higher food and energy prices, governments should provide targeted, temporary, and direct support to vulnerable households, while allowing domestic prices to adjust.

While taking steps to address energy security concerns raised by the war in Ukraine, policymakers should intensify efforts to implement the 2021 United Nations Climate Change Conference (COP26) roadmap to achieve net-zero targets. Amid widespread upward pressures on commodity prices, policymakers should take steps to increase the availability and lower the cost of fossil fuel alternatives and renewables while improving energy efficiency. Authorities should also focus on policies aimed at scaling up private finance in the transition to a greener economy to steer the mobilization of investment and the alignment of capital flows on a low-carbon trajectory. Toward this end, strengthening the climate finance information architecture remains paramount to enhance the development of climate transition financial instruments and shareholder engagement practices. This includes improving the availability of high-quality, consistent, and comparable

climate-related data; developing science-based classifications for climate finance to align capital flows with net-zero goals; and implementing global climate-related disclosure standards that involve transition plans.

Policy Recommendations to Address Specific Financial Stability Risks

The deterioration in the economic outlook and the withdrawal of monetary accommodation and other policy support measures may pressure bank asset quality, so supervisory authorities should ensure that asset classifications and loan-loss provisions accurately reflect credit risk and losses. Any significant decline in capital ratios should be accompanied by a credible capital restoration plan. Authorities should also determine whether financial institutions have a comprehensive risk management process, with a special focus on credit, market, and counterparty risks. Authorities should ensure that broker dealers have appropriate visibility and buffers for aggregate derivatives exposures, including adequate capital and margin requirements for derivatives that are not centrally cleared.

The surge in volatility and (associated) dislocations in commodity markets underscore the importance of ensuring the adequacy of disclosures and standards of transparency to counterparties, especially major financial institutions such as dealer banks. These institutions are exposed to commodity markets through provision of funding and risk-hedging services. Adequate disclosures and transparency standards are essential to supporting comprehensive and strong risk management within the financial sector and its oversight by supervisory authorities. Robust risk management at these financial institutions is paramount, particularly the adequacy of margining and stress testing vis-à-vis concentration, market, and credit risks.

While margin calls appear to have been generally orderly and not disruptive to market functioning so far, recent measures taken in markets and exchanges in response to elevated volatility in commodity prices highlight the need to examine the broader implications of such efforts. For example, commodity markets function differently than securities markets, and trading disruptions could exert significant adverse impacts on the real sector. Exchanges and central counterparty clearing houses should also ensure the robustness and resilience of their information technology systems to withstand current trading conditions. Governance mechanisms for the LME

need to be strengthened to address conflict of interest. Measures must be in place to ensure that the concentration of trading does not adversely impact free and fair markets. Supervisors and regulators should consider enhancing transparency, in both exchange-traded and over-the-counter markets, to preempt the buildup of concentrated positions and thereby limit financial stability implications.

*Recent developments related in particular to the nickel market on the London Metal Exchange (LME) suggest that there are a number of potential lessons for policymakers to consider.*⁴⁷ While the stated objective of the cancellation of trades by the LME was to stabilize the nickel market, counterparties with long positions were put at a disadvantage. Reportedly, large commodity traders have voiced concerns over the longer-term impact of the cancellation and price change limits on market confidence and participation. This risks a migration of exchange-traded contracts into uncleared over-the-counter derivatives, which are more opaque and do not have the same mechanisms for mitigating counterparty risks. Disruptions in commodity derivative markets are particularly problematic at the current juncture of volatile prices and supply bottlenecks. Broadly speaking, a disruption in trading needs to balance financial stability and free and fair market objectives; the adequacy of governance mechanisms of market infrastructure institutions requires careful review from the perspective of mitigating conflict of interest; and further assessment may be required concerning the need to enhance transparency in exchange-traded and over-the-counter markets to improve the technical soundness of exchange platforms and avoid concentration of trading (with its implications on fair trade).

The recent escalation of geopolitical tensions and their ramifications in the cyber domain have highlighted the importance of incorporating cyber risk into financial stability analysis. It is paramount to ensure that cyber regulation and supervision are fit for purpose and that response and recovery capacity is improved to ensure operations can quickly resume if an attack occurs. Enhancing information-sharing and incident reporting frameworks and helping emerging market economies build cybersecurity capacity are key to ensuring that all nodes of the network are resilient. Stepping up

international efforts to prevent and deter attackers would reduce the threat at its source. Addressing all these gaps requires a comprehensive international collaborative effort.

Policymakers need a multifaceted policy strategy to preserve the effectiveness of capital flow management measures in an environment of increasing use of crypto assets (see He and others, forthcoming). Essential steps include developing a comprehensive, consistent, and coordinated regulatory approach to crypto assets,⁴⁸ and applying it effectively to capital flow management measures; establishing international collaborative arrangements for implementation; addressing data gaps; and leveraging technology (“regtech” and “suptech”). Implementation of the existing Financial Action Task Force standards is key to mitigating financial integrity risks that might give rise to illicit capital flows. Finally, laws and regulations for foreign exchange and capital flow management measures should be reviewed and amended if necessary to cover crypto assets even if they are not classified as financial assets or foreign currency.

Policymakers need to urgently develop appropriate macroprudential tools to address risks from nonbank financial intermediation (NBFIs). Nonbanks play an increasingly important role in the financial system, including intermediating cross-border capital flows. It is essential that risks from NBFIs are effectively managed and that authorities have the right tools to supervise and regulate NBFIs. The IMF continues to work closely with the Financial Stability Board and standard setting bodies to develop these tools.

To fend off cryptoization risks, strengthening macroeconomic policies is necessary but may not be sufficient given the unique challenges posed by the crypto ecosystem. A broader discussion of policy recommendations can be found in the October 2021 GFSR and He and others (forthcoming). Central bank digital currencies may also help reduce cryptoization pressures driven by a need for better payment technologies.

The international community should work to prevent further fragmentation of the global payment system. Fragmentation would lead to reduced efficiency of international payments, with subsequent efficiency loss and fragmentation for trade and finance. Continued and deepened international cooperation is necessary to achieve this. The IMF can be an important facilitator of this cooperation.

⁴⁷On April 4, 2022, UK regulators announced a review of the LME's approach to managing the suspension and resumption of the market in nickel.

⁴⁸The elements of such an approach are further discussed in Bains and Sugimoto (forthcoming).

Authorities in emerging and frontier markets need to safeguard against risks related to tighter external financial conditions. Countries with stronger fiscal positions and clearer policy frameworks will be better positioned to manage tighter conditions. There is a need to rebuild fiscal policy space and retire extraordinary crisis measures where possible, especially in some commodity-exporting economies that have seen an improvement in terms of trade and experienced positive growth surprises. Given the significant volatility in financial markets since the start of the war in Ukraine, appropriate use of foreign exchange intervention measures may be needed, as long as they do not prevent credible macroeconomic policies and necessary adjustments. In addition to the warranted macroeconomic adjustment, in cases of crises or imminent crises, capital flow management measures may be an option for some countries to limit outflow pressures. For weaker sovereign borrowers, enhanced efforts to contain the risks from high debt and weak recovery should continue, including via multilateral cooperation and decisive support from the international community.

Some firms and sectors may need short-term fiscal support to navigate the consequences of the war in Ukraine. The corporate sector outlook has deteriorated since the Russian invasion of Ukraine, including as a result of the surge of energy and raw material prices, adding to the preexisting vulnerabilities from the pandemic.

While corporate balance sheets have continued to strengthen, benefiting from unprecedented policy support and the ongoing economic recovery, smaller firms may be less resilient and more exposed to a tightening in financial conditions and a more stringent lending posture by banks. Solvency risk has remained elevated for small firms in some countries. Direct government support to firms may be needed to prevent the risk of a wave of bankruptcies. Such support should depend on firms' viability⁴⁹ and available fiscal space and be limited to circumstances in which there was clear market failure.⁵⁰ It is crucial that policymakers continue to undertake structural measures, including strengthening insolvency frameworks via a fast-track process.

Amid heightened uncertainty, financial stability risks stemming from risky credit markets should be mitigated. Supervisors should take a comprehensive view of risks, intensify monitoring, and enforce sound underwriting standards and risk management practices at banks and non-bank financial intermediaries active in these segments. Supervisors should ensure that more comprehensive stress tests—incorporating macro-financial feedback effects from high corporate sector indebtedness, as well as correlated risks in related sectors (such as commercial real estate)—are conducted for banks and non-bank financial intermediaries with significant corporate exposures.

⁴⁹See the corporate framework, including the operationalization of viability, in Chapter 1 of the April 2021 GFSR.

⁵⁰See Chapter 1 of the April 2022 *Fiscal Monitor*.

Box 1.1. Extreme Volatility in Commodities: The Nickel Trading Suspension

The London Metal Exchange (LME) suspended trading in the nickel market for six trading days after the three-month nickel forward price skyrocketed on March 8, 2022 (Figure 1.1.1, panel 1). Given that Russia is the world's third largest producer of nickel, nickel prices had been on the rise since the start of the Russian invasion of Ukraine. Reportedly, one of the world's largest nickel producers, Tsingshan Holding Group, had large short futures positions (approximately 150,000 tons, of which about 30,000 tons were on the LME and the rest were bilateral over-the-counter [OTC] exposures with various banks). Commodity producers typically hedge against price declines (yellow line in Figure 1.1.1, panel 1). As prices increased rapidly (black line), the Tsingshan Holding Group was apparently unable to post the necessary margins with its brokers at the LME as well as for the OTC derivative positions with banks. The firm also reportedly faced margin calls on its OTC trades with various banks, which it was similarly unable to meet. The LME suspended trading, canceled all contracts executed on the morning of March 8, and deferred physical delivery of maturing contracts. The LME cited orderly market grounds as a reason for its decision. On the long side of these trades were likely banks, commodity trading companies, hedge funds, and other investors standing to benefit from the price increases. Suspension of these trades, while giving some relief to counterparties holding short positions, wiped out profits of those on the other side, leading to a widespread criticism from market participants. Trading resumed on March 16 under daily price change limits, which were hit and widened various times. To contain market volatility, the LME also imposed daily price limits on other base metals and on March 24 prohibited the submission of orders outside the daily limit.

The author of this box is Torsten Ehlers.

If margins are not posted or contracts are canceled on derivatives markets, large banks acting as dealers are left with open risk positions. While dealer banks typically hold small net positions, their gross positions are very large (about 1 million metric tons in long and short positions), as they act as intermediaries in the nickel and many other derivatives markets (Figure 1.1.1, panel 2). Banks take both positions on exchanges as well as positions over the counter directly with clients. While dealers tend to run a matched book between long and short positions, if counterparties default or contracts are canceled, this leaves banks with large open positions. Indeed, several large dealer banks were reportedly left with open short positions after March 8 due to unpaid margins.

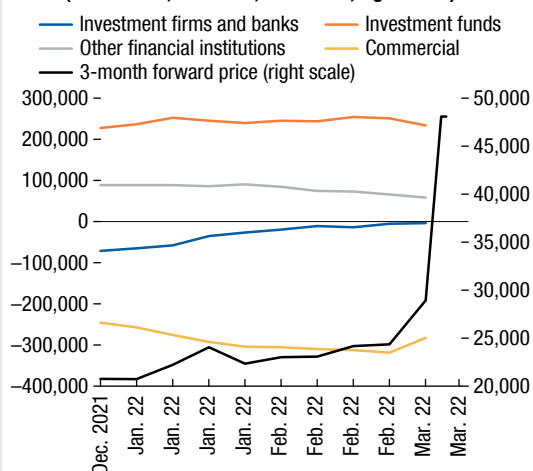
The current volatility in the commodities markets can create serious market functioning problems. Typically, prices on major commodity markets move only a few percentage points on any given day. This enables commodity producers to enter a substantial amount of both short- and long-term hedging contracts of shorter and longer maturity, as was the case on March 4 before the rapid price increase (Figure 1.1.1, panel 3). As the strike prices of outstanding options contracts indicate, the price increase on March 7 was already significantly beyond what traders were taking into consideration and hedging against (Figure 1.1.1, panel 4). During such extreme events, counterparties may not have readily available resources to fulfill their derivatives obligations. As derivatives markets are important to distribute risks among producers and consumers of commodities, an impairment of derivatives markets may ultimately spill over into the already strained availability of commodities. More broadly, strains in derivatives markets may create liquidity stress and concerns about counterparty risk that may spill over to other corners of the financial system.

Box 1.1 (continued)

Figure 1.1.1. The Nickel Market Short Squeeze in March 2022

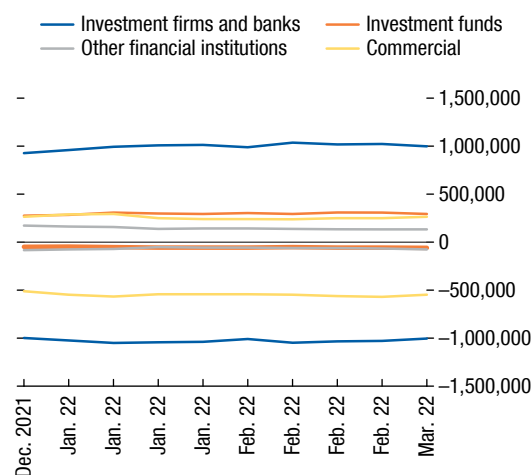
Nickel producers (commercial traders) consistently run short positions for hedging ...

1. Net Trader Positions in the Nickel Derivatives Market
(Negative = net short position)
(Metric tons, left scale; US dollars, right scale)



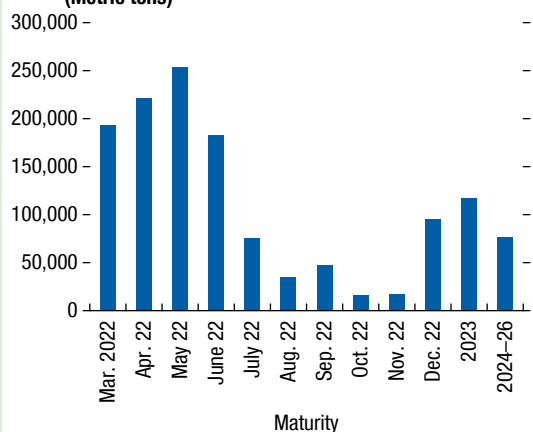
... while investment firms and banks hold the largest gross positions.

2. Gross Trader Positions
(Metric tons)



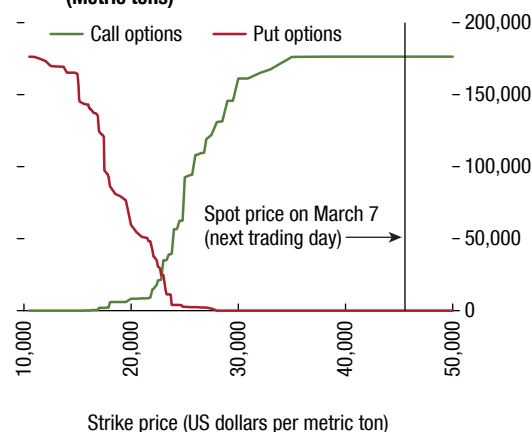
A large amount of nickel forward contracts stuck before the price increase is still outstanding.

3. Open Interest in Nickel Forward Contracts by Maturity
as of March 4, 2022
(Metric tons)



All call options outstanding on March 4, 2022, were "in-the-money" at prices prevailing on March 7/8, 2022.

4. Open Interest of "In-the-Money" Nickel Options at Given Strike Price as of March 4, 2022
(Metric tons)



Sources: Bloomberg Finance L.P.; London Metal Exchange; and IMF staff calculations.

Note: Panel 4 depicts open interest (that is, active long positions) for all call options at or above the strike price and put options at or below the strike price ("in-the-money" options). Options have a maturity of maximum two years but mature mostly in 2022.

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Chapter 2 at a Glance

- Holdings by banks of domestic sovereign debt have surged in emerging markets during the COVID-19 pandemic, on average accounting for about one-fifth of banking sector assets and 200 percent of their regulatory capital.
- The larger holdings of domestic sovereign debt by emerging market banks have deepened the ties between the sovereign and banking sectors—the so-called sovereign-bank nexus. With public debt at historically high levels and the sovereign credit outlook deteriorating in many emerging markets, a deeper nexus poses risks of an adverse feedback loop that could threaten macro-financial stability.
- This chapter examines the sovereign-bank nexus in emerging markets, focusing especially on the COVID-19 pandemic, and puts forward policy options to minimize its potential risks and enhance resilience.
- The transmission of risks between the sovereign and banking sectors is significant—both directly and indirectly through the nonfinancial corporate sector.
- An increase in sovereign risk can adversely affect banks' balance sheets and lending appetite, especially in countries with less-well-capitalized banking systems and higher fiscal vulnerabilities. It can also constrain funding for the nonfinancial corporate sector and reduce its capital expenditure.
- Amid tightening global financial conditions, heightened geopolitical tensions, and large public financing needs, emerging markets face complex policy trade-offs. Given the multifaceted nature of the sovereign-bank nexus, the policy response to mitigate risks must be tailored to country-specific circumstances and should include:
 - Better targeting of spending and strengthening of medium-term fiscal frameworks in countries with limited fiscal space and tight borrowing constraints to build resilience and mitigate the impact of an adverse shock
 - Preserving bank resources to absorb losses by restricting capital distribution where needed
 - Conducting bank stress tests by taking into account the multiple channels of the nexus
 - Examining options to weaken the nexus—such as capital surcharges on banks' holdings of sovereign bonds above certain thresholds—once the economic recovery has taken hold and pandemic-related financial sector support measures have been withdrawn
 - Continuing efforts to foster a deep and diversified investor base to strengthen market resilience in countries with underdeveloped local currency bond markets
- Given that risks from the sovereign-bank nexus are not limited to emerging markets but have also manifested in advanced economies in the past, the Basel Committee on Banking Supervision could consider resuming its efforts to develop international standards that reflect a more risk-sensitive regulatory and supervisory treatment. To begin with, and in order to foster market discipline, banks should be mandated to disclose data on all material sovereign exposures.

Introduction

The increase in public debt in the wake of the COVID-19 pandemic has reinforced the relationship between sovereigns and banks in emerging market economies. The average public-debt-to-GDP

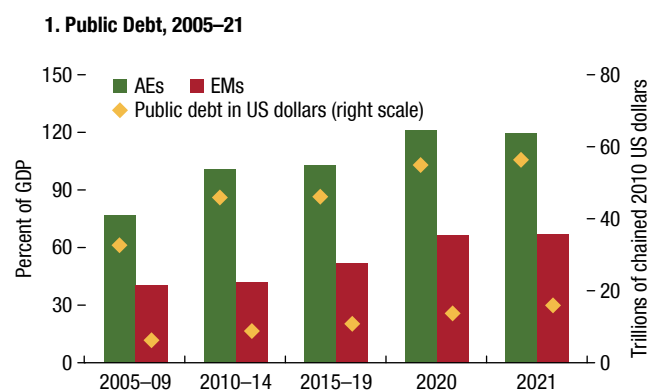
ratio in emerging markets surged to a record 67 percent in 2021 from about 52 percent before the pandemic, as economic activity declined and governments greatly increased fiscal support to nonfinancial firms and households to cushion the impact of the crisis (Figure 2.1, panel 1).¹ Although public

The authors of this chapter are Andrea Deghi (team lead), Salih Fendoglu, Tara Iyer, Oksana Khadarina, Hamid Reza Tabarraei, Yizhi Xu, Dmitry Yakovlev, and Mustafa Yasin Yenice, under the guidance of Fabio Natalucci, Mahvash Qureshi, and Jérôme Vandenbussche. Viral Acharya served as an expert advisor.

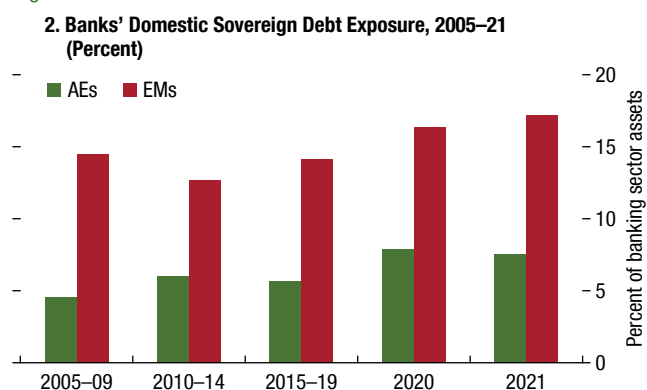
¹Henceforth, the chapter uses the shorthand “firms” for nonfinancial firms; that is, small, medium, and large enterprises other than banks and other financial institutions.

Figure 2.1. Developments in Emerging Market Public Debt and Banks' Sovereign Exposures

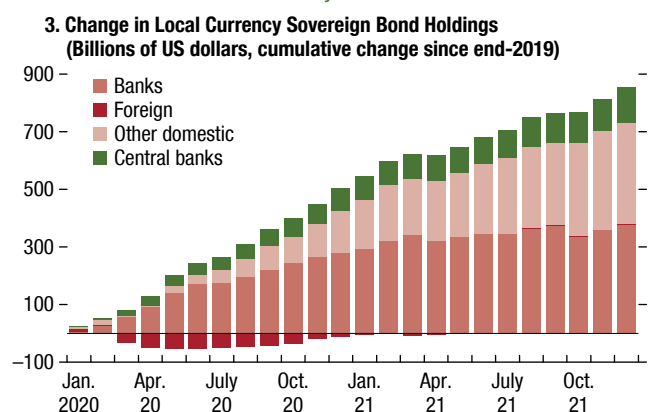
Public debt has surged in emerging markets ...



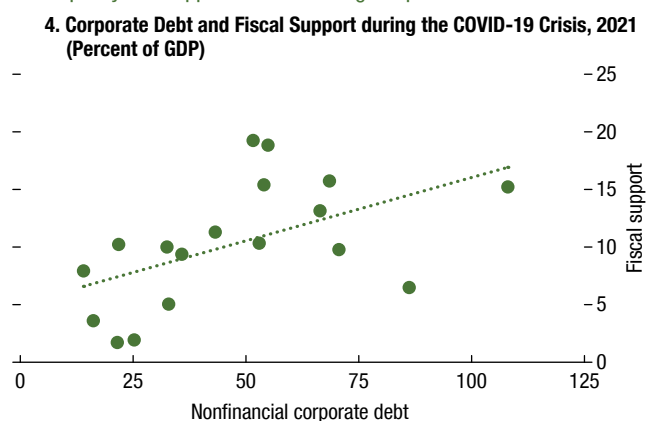
... and banks' domestic sovereign debt exposure has reached historic highs ...



... as banks have been the main buyers of domestic debt.



Fiscal policy has supported firms during the pandemic.



Sources: Fitch Connect; IMF, Monetary and Financial Statistics, World Economic Outlook, and Fiscal Monitor databases; and IMF staff calculations.

Note: In panels 1 and 2, indicators are country averages weighted by purchasing-power-parity GDP. Public debt is in real terms; that is, in trillions of chained 2010 US dollars. In panel 2, banks' sovereign exposure corresponds to claims on central government debt divided by total banking sector assets. Advanced economies comprise economies classified as advanced in the IMF World Economic Outlook database. In panel 4, fiscal support corresponds to the discretionary fiscal support announced or taken during the COVID-19 crisis expressed as a percent of GDP. For 2021, fiscal support and the corporate-debt-to-GDP ratio shown in the panel correspond to September data. See Online Annex 2.1 for countries in the emerging market sample. AEs = advanced economies; EMs = emerging markets.

debt levels have also risen in advanced economies, the domestic sovereign debt exposure of banks has increased relatively more in emerging markets (Figure 2.1, panel 2)—reaching 17 percent of total banking sector assets in 2021—as the additional government financing needs have been met mostly by domestic banks amid declining foreign participation in local currency bond markets and a generally limited domestic investor base (Figure 2.1, panel 3). Consequently, the linkages between the financial health of the sovereign and banking sectors—the so-called sovereign-bank nexus—have intensified in these economies.

The relationship between sovereigns and banks has also become more complex during the pandemic

as interdependencies with the real sector have deepened. Countries across the world have supported the liquidity and solvency of firms through unprecedented policy measures, including accommodative monetary policy and fiscal measures such as cash transfers, equity injections, loans, and guarantee programs. In emerging markets, the discretionary fiscal response to the pandemic averaged about 10 percent of GDP during 2020–21—of which 6 percent consisted of additional spending and forgone revenues and 4 percent consisted of equity, loans, and guarantees. In turn, the corporate sector has become highly dependent on the continuation of policy support in cases where the economic recovery has yet to firmly take hold and corporate vulnerabilities are high (Figure 2.1, panel 4). This has

significantly deepened the interconnectedness of sovereigns and banks through firms, so that stress in the sovereign sector could spill over quickly to firms and hurt banks' balance sheets.²

Emerging markets are particularly vulnerable to the macro-financial stability risks associated with a strong sovereign-bank nexus in the face of an adverse shock as global financial conditions tighten. Growth prospects are generally weaker relative to the pre-pandemic trend in emerging markets compared with advanced economies (see the April 2022 *World Economic Outlook*), while governments' ability to support the economic recovery through increased spending or reduced revenues (fiscal space) is more limited, with a higher debt-servicing burden (Figure 2.2, panel 1). The public-debt-to-GDP ratio is thus projected to continue to grow in several emerging markets over the medium term, while it is expected to decline in advanced economies (Figure 2.2, panel 2). At the same time, refinancing risks are higher in emerging markets given the shorter average maturity profile of public debt compared with advanced economies (see the October 2021 *Fiscal Monitor*), a higher share of public debt denominated in foreign currency (especially in US dollars), and rising sovereign spreads amid a worsening sovereign credit outlook (Figure 2.2, panels 3–5). Local currency government bond yields have also increased for most emerging markets in recent months as foreign participation in local currency bond markets has declined, while central banks have tightened monetary policy on the heels of rising inflationary pressures (Figure 2.2, panel 6; see also Chapter 1).

Amid higher fiscal vulnerabilities, a sharp tightening in global financial conditions on the back of monetary policy normalization in advanced economies and intensifying geopolitical tensions caused by the conflict between Russia and Ukraine could push emerging market borrowing costs higher and potentially trigger an adverse feedback loop between the sovereign and banking sectors through multiple channels.³ For example,

²The sovereign-bank nexus has strengthened in some advanced economies as well, particularly in Europe. ECB (2020) documents considerable heterogeneity in banks' sovereign debt exposure across European countries and notes that banks' vulnerability to higher holdings of sovereign debt securities has been contained during the pandemic, since valuation changes have been modest.

³Commodity-importing emerging markets may be particularly at risk as they face the prospect of tighter global financial conditions and high commodity prices putting pressure on their external accounts.

with public debt already elevated, higher sovereign borrowing rates could fuel debt sustainability concerns and adversely affect banks' funding conditions and balance sheets through their *exposure* to sovereign debt.⁴ In this regard, it is worth noting that countries whose banks are more exposed to sovereign debt are also those with a higher public-debt-to-GDP ratio and lower bank capital ratios (Figure 2.3, panels 1 and 2; see also Chapter 1). Sovereign stress could thus potentially quickly transmit to the banking sector in these economies.⁵ Tighter borrowing constraints could also reduce governments' ability to support banks through implicit or explicit guarantees (the *safety net*), increasing stress in the banking sector and, in turn, raising the need for actual fiscal support and further weakening the sovereign balance sheet. In addition, a widening of sovereign spreads amid constrained fiscal space could lead to a rapid withdrawal of policy support to the *real economy*, hurting economic growth and intensifying bank losses that could further magnify the sovereign stress.

Domestic shocks such as a weaker-than-anticipated economic recovery in emerging markets amid the spread of new COVID-19 variants could also unleash the pernicious dynamics of the sovereign-bank nexus. For example, a decline in economic activity could put public finances under pressure and worsen the sovereign credit outlook, leading to an increase in sovereign funding costs. A substantial rise in corporate bankruptcies could also undermine banks' capital adequacy and diminish their willingness to lend, further undermining economic activity and straining sovereign balance sheets.⁶

Against this backdrop, this chapter examines the relevance of the sovereign-bank nexus in emerging markets for macro-financial stability and puts forward policy options to minimize potential risks and enhance resilience. Building on earlier research on the topic, which has focused mostly on advanced

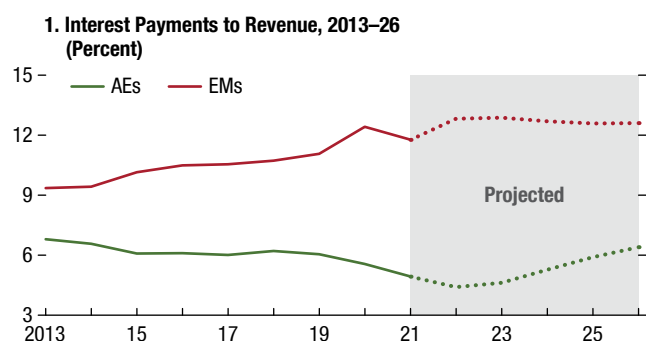
⁴These effects could be aggravated if tighter global financial conditions were accompanied by a large reversal in capital flows from emerging markets, inducing sharp currency depreciation and raising the domestic currency burden of liabilities denominated in foreign currency (Chapter 1 of the April 2022 *Fiscal Monitor*).

⁵In some major emerging markets, banks hold floating-rate bonds, inflation-indexed bonds, and "non-defaultable" bills issued by central banks, which may be less sensitive to interest rates and sovereign risk and could provide some insulation from a rise in sovereign risk.

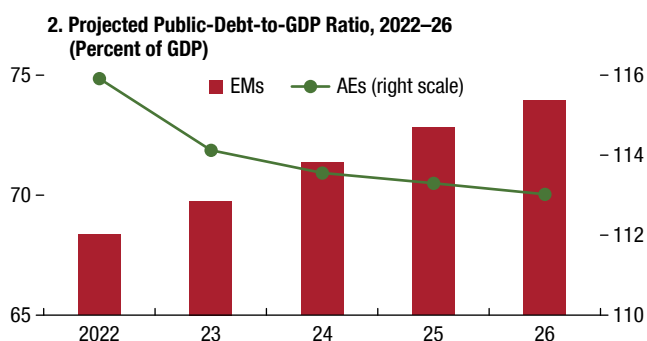
⁶Although banks remain generally well capitalized in emerging markets, pandemic-related regulatory flexibility and other supportive financial sector policy measures make it difficult to precisely ascertain the true health of the banking system at this time.

Figure 2.2. Fiscal Vulnerabilities in Emerging Markets

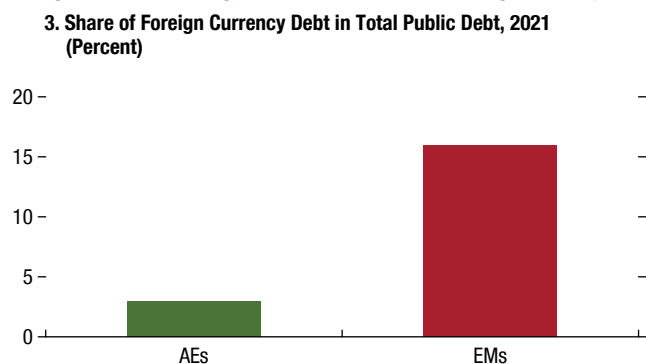
Emerging markets have much higher debt-service burdens relative to advanced economies ...



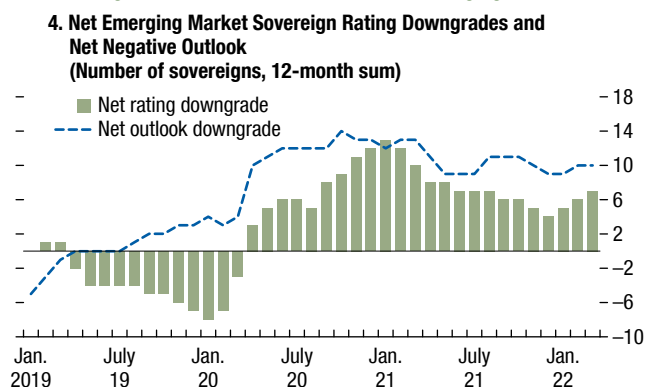
... and rising debt levels in the medium term.



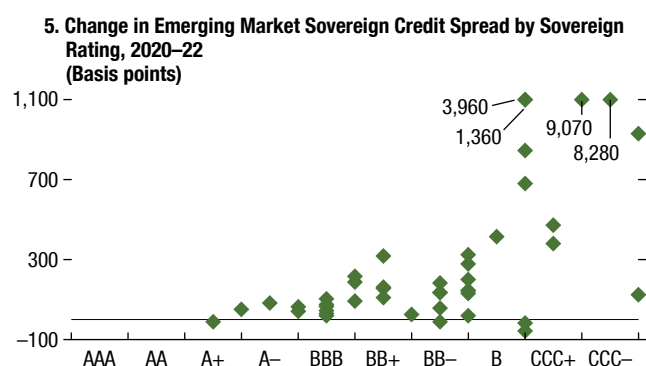
A large share of sovereign debt is denominated in foreign currency.



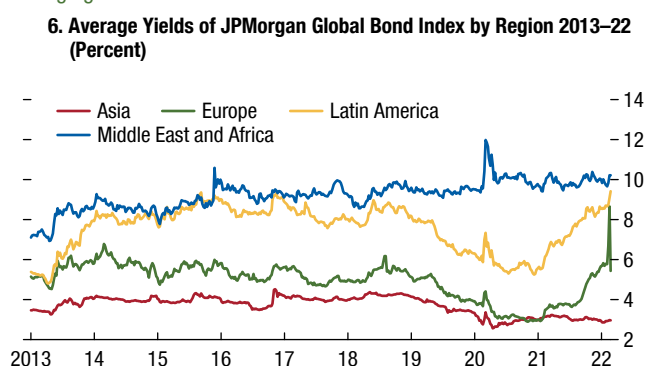
The sovereign credit outlook has worsened in emerging markets ...



... and spreads are above pre-pandemic levels.



Local currency government bond yields have also risen for most emerging markets in recent months.



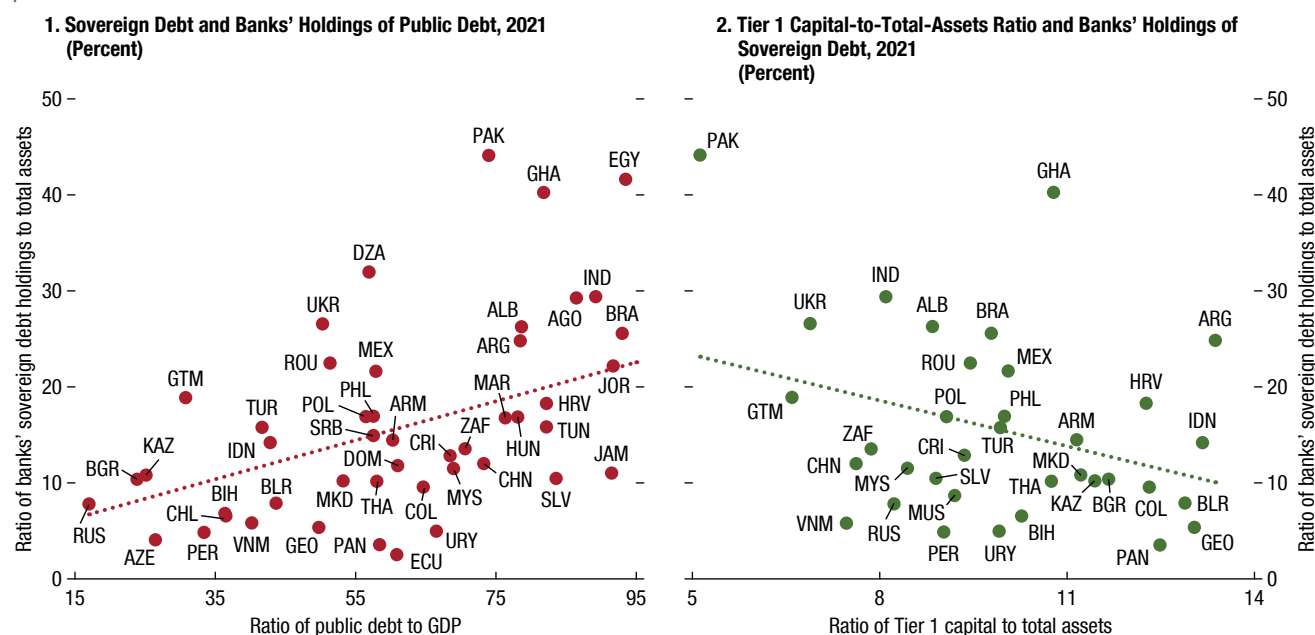
Sources: Bloomberg Finance L.P.; Fitch Connect; JPMorgan EMBI Global; Standard & Poor's Capital IQ; and IMF staff calculations.

Note: In panels 1–3, indicators are country averages weighted by purchasing-power-parity GDP. In panel 4, changes in sovereign rating and rating outlook are computed using a 12-month rolling sum based on changes reported by Standard & Poor's. Panel 5 shows the difference in credit spreads between December 31, 2020, and March 11, 2022. Spreads are calculated as the difference between a bond's yield and the linearly interpolated yield of the two base curve bonds that bracket the maturity of this bond. In panel 6, the drop in average yields for Europe in the second week of March 2022 reflects the exclusion of Russia from the JPMorgan index. AEs = advanced economies; EMs = emerging markets.

Figure 2.3. Banks' Exposure to Sovereign Debt in Emerging Markets

Banks' exposure to sovereign debt is greater in economies with higher public debt ...

... and lower bank capital.



Sources: Fitch Connect; IMF, Financial Soundness Indicators, Monetary and Financial Statistics, and World Economic Outlook databases; and IMF staff calculations. Note: In panel 1, red dots reflect provisional public-debt-to-GDP ratios in 2021 vis-à-vis banks' central government debt holdings in 2021 (third quarter). In panel 2, total assets are used in the denominator of the Tier 1 capital ratio (instead of risk-weighted assets) to provide greater comparability across countries. Given limited country-level data availability, banks' sovereign debt exposures for India and Argentina are computed using bank-level Fitch Connect data. Data labels use International Organization for Standardization (ISO) country codes.

economies,⁷ the chapter explores the strength of the nexus in emerging markets, especially during periods of sovereign stress, and the key channels of transmission.⁸ Specifically, relying on a comprehensive conceptual framework and drawing on data from the past two decades for a broad sample of emerging

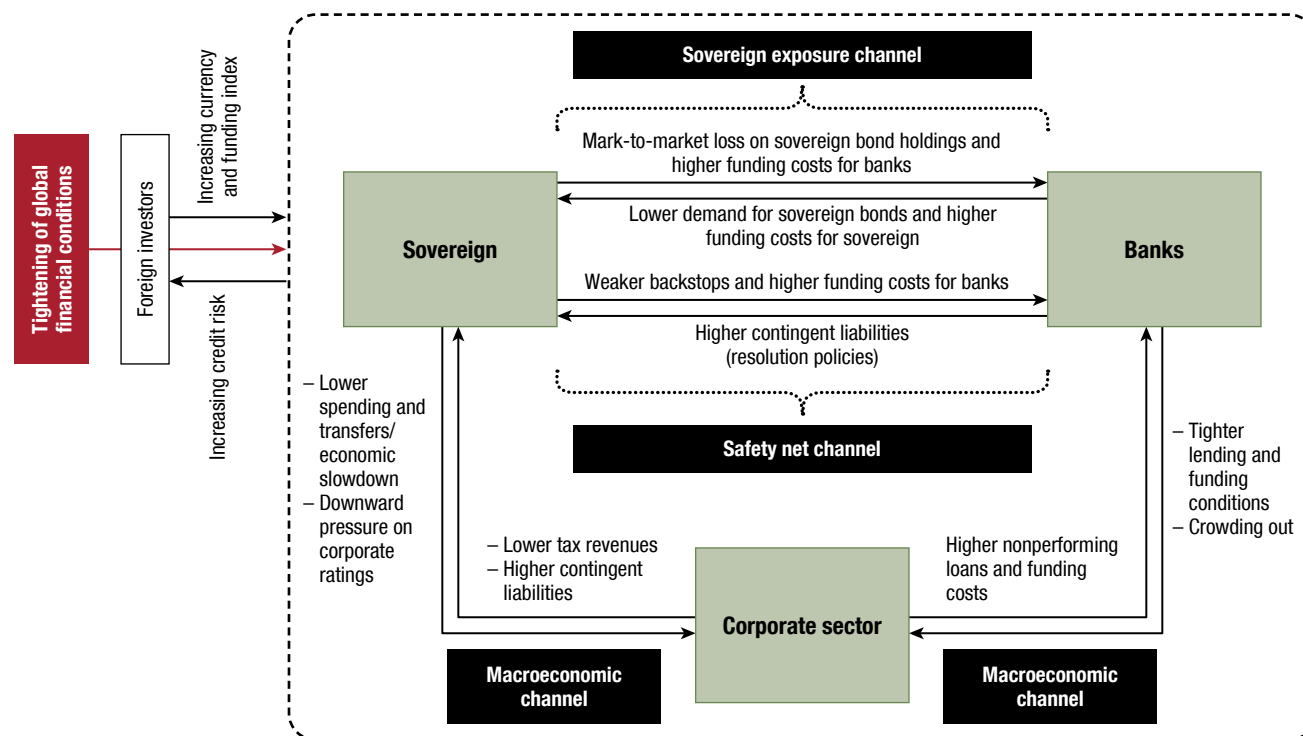
markets,⁹ the chapter investigates the following key questions:

- How has the link between the sovereign and banking sector evolved, and how has the COVID-19 pandemic affected that link? What factors motivate the banking sector to hold sovereign debt?
- How strong is the sovereign-bank nexus? How is it affected by adverse shocks such as a tightening in global financial conditions?
- How relevant are the various channels of transmission? To what extent does sovereign stress transmit directly to banks through their exposure to government bonds? How much do banks benefit from government guarantees, especially during episodes of sovereign stress? And to what degree does sovereign stress affect the real economy—in particular the corporate sector, which may in turn affect banks?

⁷The linkage between sovereign and banking sector risk has been well explored for advanced economies, especially in the context of the euro area sovereign debt crisis (for example, Acharya and others 2018; Dell'Ariccia and others 2018). The findings of these studies, however, may not be generalizable to emerging markets, which have different structural characteristics—notably in terms of lower financial sector development, a greater share of foreign-currency-denominated public debt, and higher sensitivity to external shocks. Gennaioli, Martin, and Rossi (2018) and Feyen and Zuccardi Huertas (2019) document the existence of a sovereign-bank nexus in emerging markets using pre-COVID-19 pandemic data. IMF (2022) discusses the deepening of the sovereign-bank nexus in recent years in the context of South Africa.

⁸Although shocks to the banking sector could also trigger the feedback loop, the elevated fiscal vulnerabilities in emerging markets, combined with the risk of a sharp tightening in global financial conditions as monetary policy normalizes in advanced economies, makes an increase in sovereign stress more relevant at the current juncture.

⁹The core sample of emerging markets comprises 53 economies. The specific sample of economies across empirical exercises and the time period covered depend on data availability. See Online Annex 2.1 for details. All online annexes are available at www.imf.org/en/Publications/GFSR.

Figure 2.4. Key Channels of the Sovereign-Bank Adverse Feedback Loop

Source: IMF staff.

Note: A sudden tightening of global financial conditions is one type of shock that may trigger an adverse sovereign-bank feedback loop. Other possible shocks include a terms-of-trade shock that may affect the sovereign, banking, and corporate sectors; a domestic banking crisis triggered by a deposit run that could disrupt credit supply to the corporate and household sectors, reducing economic activity and leading to fiscal sustainability pressures; and a shock to economic activity, for example, because of a health crisis or natural disaster, which could strain sovereign and banking sector balance sheets.

Sovereign-Bank Interlinkages: Conceptual Framework

The sovereign and banking sectors are connected through three key channels that facilitate the transmission of shocks from one sector to the other, interacting with and magnifying vulnerabilities in each sector and generating adverse feedback loops (Figure 2.4). The first channel stems from the *direct exposure* of banks to sovereign risk through their holdings of government debt. A rise in sovereign spreads could reduce the market value of government debt that banks hold and use as collateral to secure financing. As a result, banks could face higher funding costs and liquidity strains, potentially restricting their capacity to lend to the real economy.¹⁰

¹⁰A haircut applied to government debt exposures will lead to capital losses for banks unless the losses have already been absorbed by provisioning and mark-to-market accounting. As noted in IMF (2021), a timely and carefully designed domestic debt restructuring can limit the losses for banks and the impact on the broader economy.

The second channel relates to the *safety net*, or government support provided to banks in the form of implicit and explicit guarantees.¹¹ Sovereign stress could reduce these funding benefits, threatening the stability of banks. A weaker banking sector may in turn increase the need to activate the guarantees, straining fiscal accounts and further aggravating pressures on the sovereign. In some emerging markets, governments hold substantial bank equity, which could lead to additional fiscal losses (on top of potential recapitalization needs) if banks face financial pressure.

¹¹Such guarantees are provided to support banks and reduce the likelihood of a financial disruption if the banking sector comes under severe financial stress. As discussed later in the chapter, this channel is likely to be stronger for domestic state-owned banks—which are also more likely to be financing the fiscal deficit, relaxing the government's borrowing constraint and potentially leading to greater public debt accumulation. Because these banks also tend to be subject to limited market discipline and weak governance and supervision, they could pose additional financial stability risks (Feyen and Zuccardi Huertas 2019).

The third channel refers to the indirect feedback loop effect between sovereigns and banks through the broader *macroeconomy*, in particular the corporate sector. A weakening of the sovereign balance sheet could hurt the corporate sector by raising borrowing costs, or through fiscal consolidation (for example, by raising taxes or reducing expenditure) and policy uncertainty. It may also increase the burden on domestic banks to finance government debt, crowding out bank lending to the corporate sector and affecting economic activity.¹² A weaker corporate sector could in turn have a negative impact on banks' balance sheets because of possible deterioration of its loan portfolio quality and higher credit provisioning. Subsequently, stress in the banking sector could disrupt economic activity even further, impairing government finances and transmitting stress back to the sovereign.

These three channels could also work in reverse—that is, stress in the banking sector could lead to sovereign stress—for example, by disrupting the government bond market, activating fiscal backstops, or dampening economic activity. Moreover, these three channels tend to feed into one another as financial conditions tighten, thus transmitting and amplifying shocks from one sector to the other, weakening balance sheets and creating a mutually reinforcing vicious “doom loop.”¹³

That said, well-capitalized banks could also serve as a shock absorber in times of distress by acting as a stable buyer of sovereign debt, especially in countries with a limited domestic investor base. Nevertheless, the overreliance of governments on the domestic banking sector for their financing needs is a source of significant risk—for example, by leading to a more

concentrated investor base and greater potential to amplify shocks.¹⁴

Another possible source of interconnection between sovereigns, banks, and firms is the role played by domestic nonbank financial institutions in many emerging markets. A rise in sovereign (or banking) sector risk may transmit to these institutions, which could further amplify vulnerabilities in each sector through direct and indirect exposures (both to banks and firms) and magnify the impact of the shock. Nonbank financial institutions hold a nontrivial share of public debt in some emerging markets (see Box 2.2.1 in Online Annex 2.2), but potential distress caused by these institutions may be more limited, as financial systems remain largely bank-based in emerging markets.¹⁵

Relevance of the Sovereign-Bank Nexus in Emerging Markets: Some Stylized Facts

Domestic banks have traditionally been important players in sovereign bond markets in emerging markets both as investors and market makers. Their share in sovereign debt holdings increased gradually from an average of about 20 percent two decades ago to more than 30 percent in 2020 (Figure 2.5, panel 1), but it varies considerably across countries. In some economies (such as Uruguay), banks hold less than 10 percent of total sovereign debt, while in others (such as China) this share exceeds 80 percent.¹⁶ In addition to banking sector solvency and liquidity regulations, which incentivize the holding of domestic sovereign debt relative to other claims (BCBS 2017, 2021), several other factors explain banks' exposure to sovereign debt, including

¹²“Crowding out” refers to less bank credit to the private sector because of increased lending to the government. Sovereign distress may crowd out bank lending as banks may be forced to hold more sovereign debt (moral suasion) when sovereign refinancing needs are typically higher. Banks may also engage in risk shifting and may choose to hold more government debt to profit from higher yields. For emerging markets, there is evidence of lower private sector credit growth during times of sovereign stress.

¹³The extent of the feedback loop may be affected by monetary policy. In an adverse scenario, a loosening of monetary policy (including large asset purchases) could reduce the severity of the loop by supporting economic growth and lowering domestic borrowing costs for sovereigns, banks, and firms. Furthermore, in emerging markets, the strength of the sovereign-bank nexus may also be affected by a “currency channel,” by which an external shock that triggers a currency depreciation could deepen sovereign and banking stress through balance sheet effects.

¹⁴Financial stability risks are also associated with the holding of government debt by nonbank financial institutions and foreign investors. For example, mutual funds could be prone to selling government securities in times of stress to meet liquidity needs, contributing to pressures in government bond markets. Foreign investors also tend to be skittish, and their quick withdrawal from government bond markets can create liquidity problems. Thus, the investor base needs to be well diversified to avoid overreliance on any one type of investor.

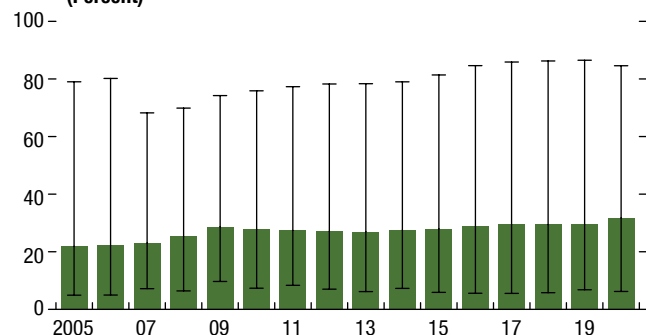
¹⁵Lack of detailed data on sovereign debt holdings of different types of nonbanking financial institutions in emerging markets (investment funds, insurance companies, pension funds, and so on), as well as on their interconnectedness with other sectors, precludes an in-depth analysis of their role in the sovereign-bank nexus in this chapter.

¹⁶In some emerging markets, banks' sovereign debt exposure declined over the past decade, as nonresident investor participation in local currency bond markets rose. This trend, however, reversed during the pandemic (Online Annex Figure 2.3.1).

Figure 2.5. Association between Emerging Market Sovereign and Banking Sector Default Risk

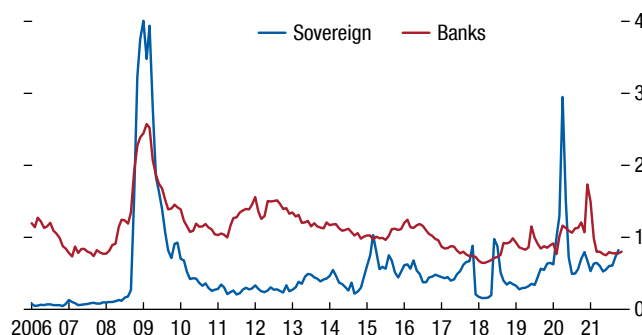
Domestic banks are major players in the sovereign debt market.

1. Share of Domestic Banks' Holding in Total Government Debt, 2005–20 (Percent)



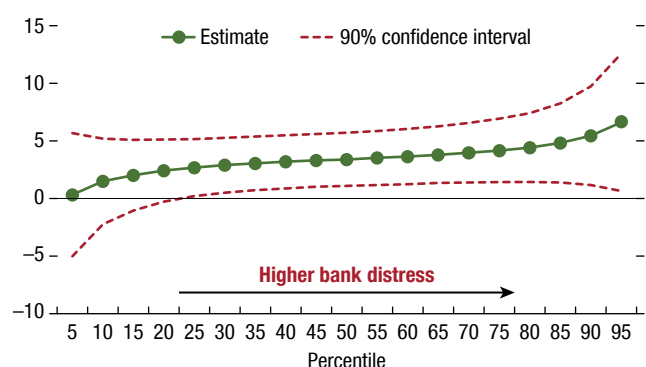
Sovereign and bank default risk move together ...

2. Sovereign and Bank Expected Default Frequencies, 2006–21 (Percent, average across countries)



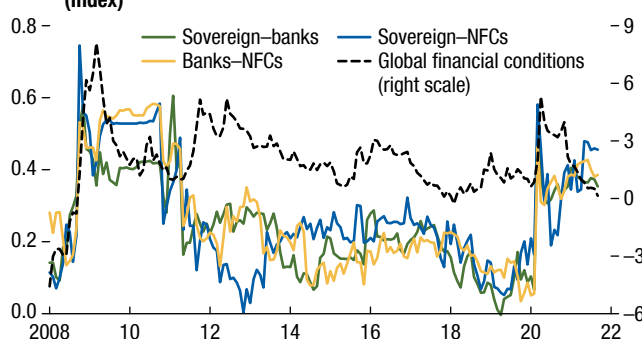
... and the correlation increases at higher levels of bank stress ...

3. Relationship between Changes in Sovereign and Bank Expected Default Frequencies, 2006–21 (Basis point)



... as well as when global financial conditions are strained.

4. Median Correlation among Sovereign, Bank, and Nonfinancial Corporate Sector Stress and Global Financial Conditions, 2008:M1–2021:M9 (Index)



Sources: Arslanalp and Tsuda (2014); Moody's; Refinitiv Datastream; and IMF staff calculations.

Note: Panel 1 shows the unweighted average of the domestic banks' share in general government debt. Bands refer to the minimum and maximum value of this share in the sample. In panel 2, banking sector expected default frequency (EDF) is equal to the average EDF of individual banks. Panel 3 shows the strength of the correlation between changes in banks and sovereign default risk at different values of bank stress calculated using a panel quantile regression with country fixed effects. Default risk is measured by the EDF. Higher bank distress refers to periods with larger changes in the banking sector EDF. Dots correspond to the effect of a change in sovereign EDF by 1 percentage point on the change in banks' EDF as computed by panel quantile regressions with country fixed effects. Panel 4 shows the median time-varying correlation between changes in sovereign, bank, and nonfinancial corporation EDFs across countries using a 24-month rolling window. The median correlation is a number between -1 and 1 . The global financial conditions indicator refers to the common component of monthly equity price returns estimated across advanced economies and emerging markets using a factor-augmented vector autoregressive model. NFCs = nonfinancial corporations.

liquidity management, higher interest rates, lower financial sector development, and government moral suasion (Box 2.1).¹⁷

The overreliance of governments on domestic banks for their financing needs, and the associated high

exposure of banks to sovereign debt, increases the likelihood of shock transmission between the two sectors. The default risks of sovereigns and banks—proxied by the expected default frequency—tend to move in lockstep in emerging markets (Figure 2.5, panel 2). Importantly, the strength of this relationship varies with the level of distress in the banking sector: at low levels of bank distress, a 1 percentage point increase in sovereign default risk is associated with a 0.4 basis point increase in banks' expected default frequency (Figure 2.5, panel 3). However, at higher levels of

¹⁷The use of domestic government bonds for liquidity management (such as to access central bank liquidity) can be a key driver of banks' preference to hold domestic rather than foreign bonds, resulting in a significant home bias. Asonuma, Bakhache, and Hesse (2015) show that when banks exhibit higher home bias, fiscal consolidation by the sovereign tends to be slower, all else equal.

Figure 2.6. Sovereign Debt and Banking Crises in a Historical Context: Emerging Markets versus Advanced Economies

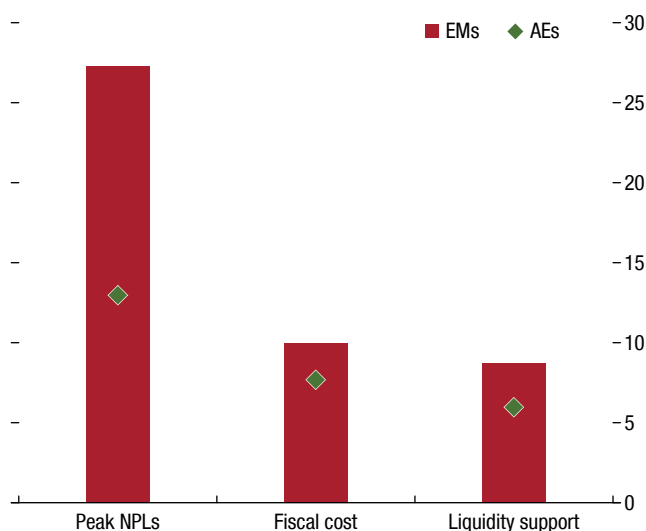
Banking and sovereign debt crises have often occurred together in emerging markets.

1. Frequency of Sovereign Default, Banking, and Currency Crises in Emerging Markets and Advanced Economies, 1971–2016 (Percent)

Type of crisis	EMs	AEs
Sovereign (domestic)	6.3	0.1
Sovereign (external)	18.5	0.5
Banking	15.0	16.1
Currency	25.8	10.9
Banking and sovereign	6.6	0.5
Banking, sovereign, and currency	5.1	0.0

Fiscal costs of banking crises have been significant in emerging markets.

2. Financial and Fiscal Costs of Banking Crises, 1971–2016 (Percent)



Sources: Emerging Portfolio Fund Research; Harvard Business School, Global Crises Data by Country; Laeven and Valencia (2018); IMF, Monetary and Financial Statistics database; and IMF staff calculations.

Note: In panel 1, banking, sovereign, and currency crises are those identified by Global Crises Data by Country, updated by the Harvard Business School based on Reinhart and Rogoff (2009). Currency crises are defined as an annual depreciation in the nominal exchange rate of at least 15 percent. The frequency of occurrence of each type of crisis is computed as the total number of country-year observations identified as the corresponding crisis as a percent of the total number of country-year observations in the sample. In panel 2, information is sourced from Laeven and Valencia (2018). Fiscal costs refer to outlays directly related to financial sector restructuring as percent of GDP. Nonperforming loans are expressed in percent of total loans. Liquidity support is measured as the ratio of central bank claims on deposit money banks and liquidity support from the Treasury to total deposits and liabilities to nonresidents. AEs = advanced economies; EMs = emerging markets; NPLs = nonperforming loans.

distress, the association is 10 times stronger. The relationship is also much tighter when global financial conditions are under strain, as is evident from the jump in the correlation between sovereign and bank default risk during the global financial crisis and at the onset of the COVID-19–related financial market turmoil in March 2020 (Figure 2.5, panel 4).¹⁸

The strong association between sovereign and banking sector risks has amplified past financial crises. Banking and sovereign debt crises have been particularly prevalent in emerging markets, frequently occurring at the same time or in succession (Figure 2.6, panel 1). Their incidence typically increases in conjunction with a tightening in global financial conditions. This tends to induce a reversal in cross-border

capital flows, making it more difficult for both sovereigns and banks to obtain funding, while also leading to sharp currency depreciations (or a currency crisis) that further strain sovereign and bank balance sheets (Reinhart and Rogoff 2009).

These mechanisms were at work in several prominent emerging market sovereign debt and financial crises of the late 1990s and early 2000s (for example, Argentina, Ecuador, Russia). In some cases, governments increasingly relied on domestic banks to fund deteriorating fiscal positions, making a banking crisis unavoidable after the eventual sovereign default.¹⁹ The fiscal cost of restructuring and supporting the financial sector associated with banking crises, however, has also been significant in emerging markets (and on par with

¹⁸Similar dynamics are observed for the correlation of sovereign and banking sector stress with nonfinancial corporate sector stress, which provides further evidence of the strengthening of relationships among the three sectors when global financial conditions tighten.

¹⁹On average, government bond holdings of banks in emerging markets increase by about 7 percentage points after a sovereign debt crisis, while they tend to decline in advanced economies (see Online Annex Figure 2.3.2).

advanced economies), suggesting a possible transmission of banking stress back to the sovereign. Furthermore, the deterioration in credit quality (proxied by a high share of nonperforming loans in total loans) during banking crises has been twice as large in emerging markets as in advanced economies, indicating the existence of a strong macroeconomic channel in the former group (Figure 2.6, panel 2).

Deepening of the Sovereign-Bank Nexus during the COVID-19 Pandemic

The relationship between sovereigns and banks in emerging markets has been reinforced during the COVID-19 pandemic, as banks' holdings of local currency government debt have increased significantly as a share of their assets (Figure 2.1, panel 2; Box 2.1). While this increase has been driven by state-owned banks in several countries, private domestic banks have also played a role (Figure 2.7, panel 1). Banks' excess liquidity, driven by weaker credit demand and a surge in deposits, appears to have been one factor behind banks' decisions to purchase more sovereign debt (Figure 2.7, panel 2).

Banks in emerging markets are generally well capitalized because of reforms enacted following the global financial crisis and policy support provided during the pandemic.²⁰ However, sovereign debt exposure constitutes a significant share of regulatory capital in some countries (Figure 2.7, panel 3). Importantly, a sizable share of banks' outstanding sovereign debt holdings follows mark-to-market accounting in several emerging markets (Figure 2.7, panel 4), which could potentially undermine banks' capital adequacy if the market value of these assets were to decline.

This risk is particularly relevant in the current environment of monetary policy normalization in advanced economies and rising global yields.²¹ To assess its implications, a simple bank-level scenario analysis is undertaken for individual emerging markets. The minimum haircuts on banks' holdings of domestic sovereign debt that would lead to a breach of the 4.5 percent

minimum regulatory common equity Tier 1 (CET1) capital ratio are computed (Figure 2.7, panel 5). When taking the median value of these haircuts across banks in a region, the results show that banking systems in sub-Saharan Africa are relatively more vulnerable to sovereign distress. Haircuts as small as 30 percent, which are probable and have already been observed in the past, would breach the minimum CET1 capital ratio in domestic banks in the region.²²

Furthermore, banking sector health depends on the viability of banks' corporate borrowers, which have faced strains during the pandemic. In most emerging markets, the sustainability of corporate debt—as measured by earning capacity relative to debt—has declined as corporate revenues have fallen (Online Annex Figure 2.3.4). While it is difficult to fully ascertain the soundness of bank balance sheets at the current juncture because of regulatory flexibility and other financial sector support measures in place,²³ nonperforming loans are more than one-tenth of total loans in some countries (Online Annex Figure 2.3.4) and could edge up as loan-repayment moratoria and other support measures are unwound (Chapter 1). An adverse shock to firms due to a rise in sovereign risk could thus have a significant impact on banking stability through the macroeconomic channel.

In this economic landscape, sovereign and bank credit risk remain closely tied in emerging markets, as reflected by the positive correlation between sovereign and bank credit ratings (Figure 2.7, panel 6), indicating that the nexus is highly pertinent. The analysis that follows more formally evaluates the strength of the nexus in emerging markets and some of the key channels of transmission.

Measuring the Strength of the Sovereign-Bank Nexus

To assess the overall strength of the nexus in emerging markets, two-way relationships between the sovereign, banking, and corporate sector default

²⁰The median capital adequacy ratio across emerging markets stood at 14 percent in 2020 (see Online Annex Figure 2.3.3), but recent global bank stress tests point to relatively lower resilience in emerging markets than in advanced economies.

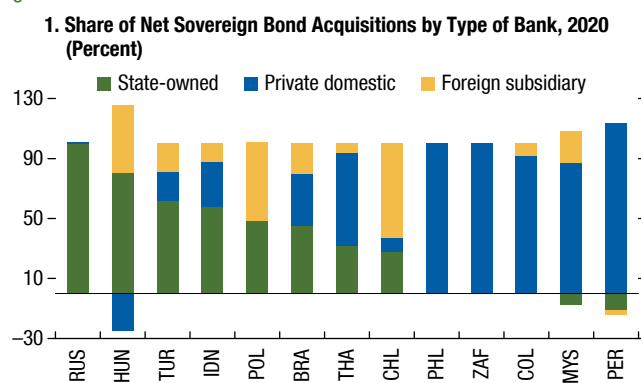
²¹Higher policy rates and higher term premia will raise yields across the term structure of interest rates, reducing the market value of bond holdings (and capital) in bank balance sheets, even if fiscal conditions are sound.

²²For further context, direct loss-given-default rates for sovereign debt holders have varied widely, but Cruces and Trebesch (2013) estimate a 37 percent average haircut for countries during 1978–2010 and a 50 percent average haircut during 1998–2010.

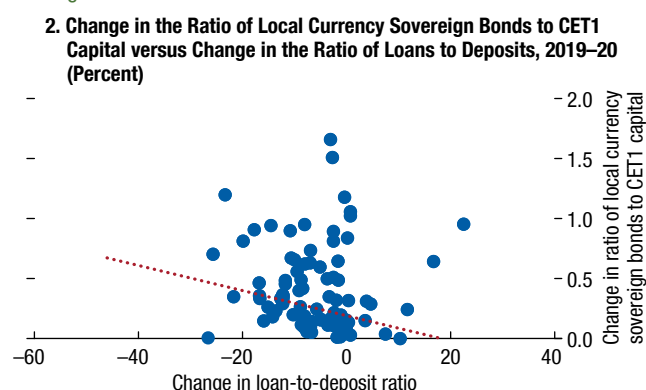
²³Regulatory flexibility refers to the temporary measures adopted by financial regulators and supervisors during the COVID-19 pandemic to ensure that banks continued to lend to the real economy—for example, the release of countercyclical capital buffers to free up lending capacity, restrictions on capital distributions, and debt payment moratoria.

Figure 2.7. Sovereign-Bank Nexus in Emerging Markets during the COVID-19 Pandemic

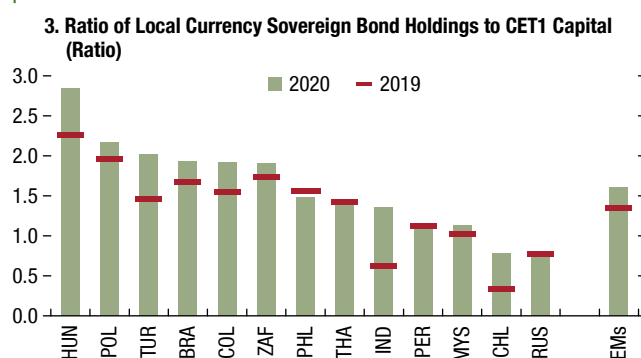
State-owned banks in several countries have been the major buyers of government debt.



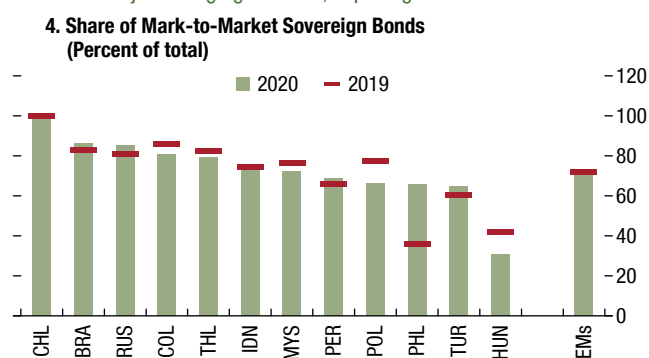
Excess liquidity is associated with banks' increased sovereign bond holdings.



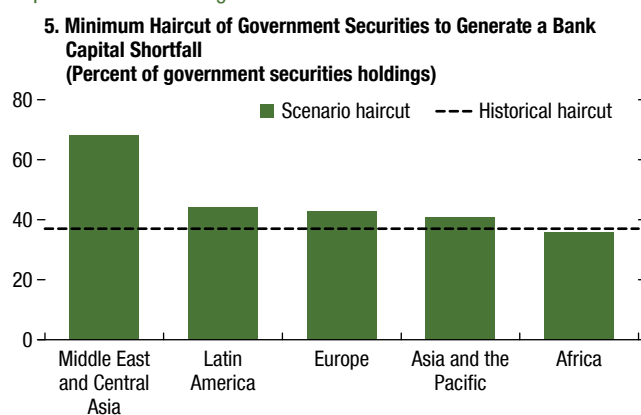
Banks' sovereign exposure relative to capital has increased during the pandemic.



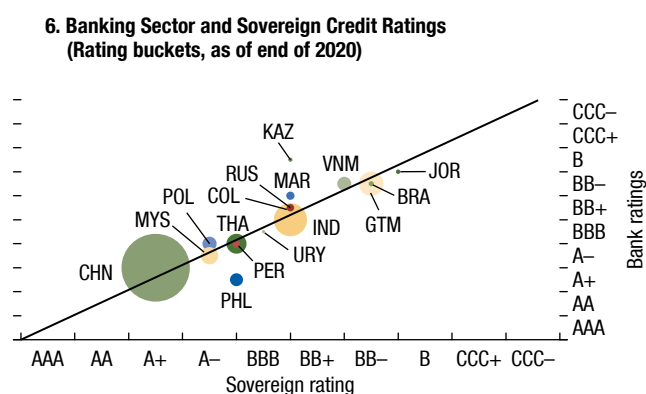
A sizable share of domestic government bond holdings is marked to market in major emerging markets, exposing banks to market risk.



A haircut of about 30–40 percent would breach the minimum CET1 capital ratio in some regions.



Bank and sovereign credit ratings are closely tied.

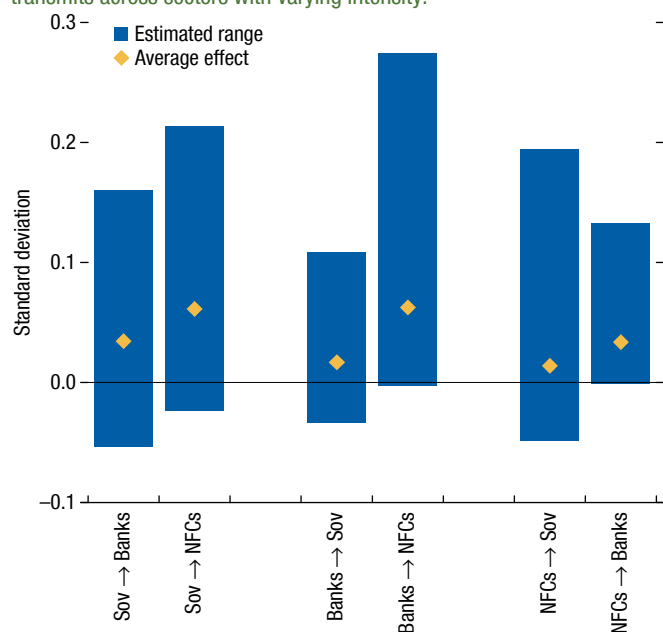


Sources: Bureau van Dijk's Orbis; Cruces and Trebesch (2013); data compiled from banks' accounting statements and Basel Pillar III disclosures; Fitch Connect; Haver Analytics; Standard & Poor's Capital IQ; IMF, Monetary and Financial Statistics database; and IMF staff calculations.

Note: In panel 5, the historical haircut corresponds to the average direct loss given default rates for sovereign debt holders across 68 economies during 1970–2010 as reported in Cruces and Trebesch (2013). The scenario haircut refers to the level of haircut to government securities that would breach the 4.5 percent minimum CET1 capital ratio, assuming other sources of capital are unavailable. This is a strict approach since it is assumed that only the highest-quality capital is accessible. The value of the haircut for each geographic region is computed as a median for banks in individual economies and over regions. In panel 6, bank credit ratings correspond to the median rating across banks in each economy. The size of the dots is proportional to the size of the banking sector. Data labels use International Organization for Standardization (ISO) country codes. CET1 = common equity Tier 1.

Figure 2.8. Transmission of Risks through the Sovereign-Bank Nexus: Strength of the Main Channels across Emerging Markets
(Effect of a one standard deviation shock on other sectors' default risk)

An increase in sovereign, bank, and nonfinancial corporation default risk transmits across sectors with varying intensity.



Sources: Haver Analytics; Moody's; Refinitiv Datastream; and IMF staff calculations.

Note: The figure shows the estimated range of coefficients for individual emerging markets obtained from a structural model using daily data of default risk for sovereign, banking, and corporate sectors. See Online Annex 2.5 for estimation details. NFCs = nonfinancial corporations; Sov = sovereign.

risks are examined for individual emerging markets, while taking into account other domestic and external factors that may impact these relationships.²⁴ Three key findings emerge from this analysis. First, the nexus is strong, on average, with significant feedback effects between sectors (Figure 2.8). Second, the strength of the transmission of risk between sectors varies. For example, spillovers from sovereign default risk to banks are, on average, larger than those in the opposite direction from banks to sovereign default risk. Overall, the largest spillovers are from sovereign and bank default risk to firms. Third, the relevance of the nexus differs

²⁴To examine the relationships, a structural value-at-risk model is estimated for 15 emerging markets using 2006–20 data; identification is achieved through Rigobon's (2003) methodology. The dependent variable is the expected default frequency (as a proxy for default risk) for the sovereign, banking, and corporate sectors. See Online Annex 2.5 for details on the empirical analysis.

across countries, with the transmission of shocks being three to five times higher than the average in some cases.

The heterogeneity in the size of the transmission of shocks suggests that some country-specific factors, such as the fiscal position and financial vulnerabilities, may be at play in amplifying the impact of an adverse shock. Further empirical analysis supports this observation. For example, after a sharp tightening in global financial conditions, emerging markets with a higher level of public debt and banks' holdings of sovereign debt experience an increase in sovereign and bank default risks that is twice as large as the average increase (Figure 2.9).²⁵ Furthermore, the impact of the shock is persistent and remains larger than the average effect for up to six quarters after the shock.

These findings confirm that the interlinkages underlying the sovereign-bank nexus are relevant in emerging markets. The next section further explores these linkages and examines some of the key channels and vulnerabilities that facilitate the transmission and amplification of shocks across sectors.

Evidence about the Transmission Channels

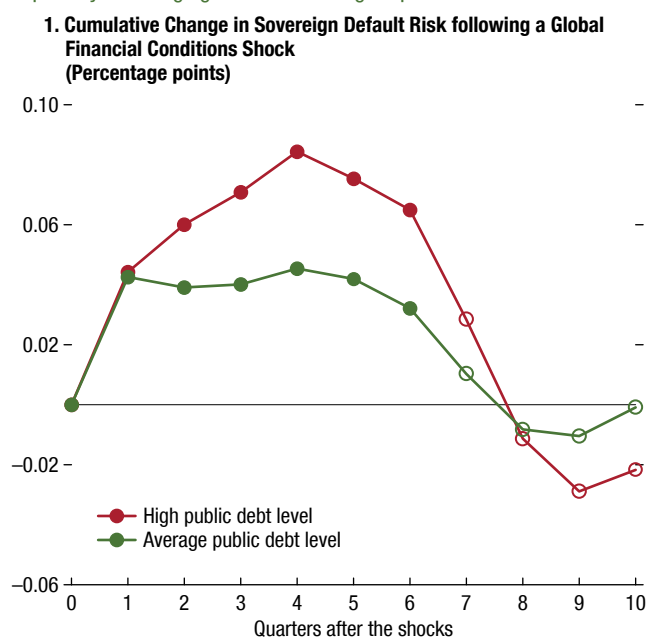
To investigate the importance of the various transmission channels underlying the nexus in emerging markets, this section focuses mainly on the direct shock transmission from the sovereign sector to the banking and corporate sectors. While shocks originating from banks and firms may also be relevant, and may interact with a sovereign shock, shock transmission from the sovereign sector to the banking and corporate sectors appears to be more pertinent at this juncture given the elevated fiscal vulnerabilities in emerging markets that make the sovereign particularly prone to an adverse shock.²⁶

²⁵For this exercise, a local projection panel regression model is estimated to exploit the cross-country variation in vulnerabilities using the same sample of countries and model specification as in Figure 2.9. High levels of public debt and bank sovereign exposure are defined as one standard deviation above the sample average (equivalent to about 80 percent and 20 percent, respectively, while the mean value is about 50 percent and 9 percent, respectively). See Online Annex 2.5 for further details.

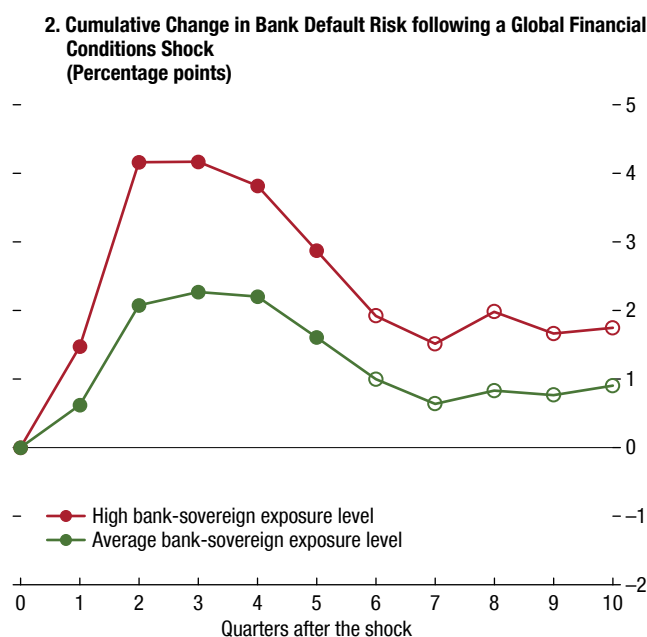
²⁶As multiple channels of the nexus could operate simultaneously, the analysis presented in the following sections is based on granular bank- and corporate-level data to better identify the effects of each individual channel. The results of these exercises, however, may not be strictly comparable and are subject to some degree of estimation uncertainty given that the sample composition varies across analyses, depending upon data availability.

Figure 2.9. Sovereign and Bank Default Risk and Tightening of Global Financial Conditions in Emerging Markets

Sovereign default risk rises after global financial conditions tighten, especially in emerging markets with higher public debt ...



... and where banks have a higher sovereign exposure.



Sources: Haver Analytics; Moody's; Refinitiv Datastream; and IMF staff calculations.

Note: Panels 1 and 2 show results from local projection models in which the sovereign and banking default risks at quarterly frequency are regressed on lagged values of each other, controlling for other domestic and external factors, including a global financial conditions index and its interaction with an indicator variable identifying countries with high public debt or high bank-sovereign exposure (with high vulnerability identified as values of public debt to GDP or a ratio of banks' holdings of government debt to total banking sector assets that is one standard deviation above the sample average). Solid dots indicate statistical significance at 10 percent or lower.

Exposure Channel

As discussed, banks hold a substantial amount of public debt, including as a share of capital, exposing them to the risk of losses on these holdings. Weaker capital buffers, in turn, can affect banks' default risk and lending behavior. Empirical analysis performed over a large sample of emerging market banks using data for the past two decades confirms this intuition.²⁷ A sovereign distress event—defined

as an explicit default or a period with sovereign credit default swap spreads higher than 500 basis points—is followed within the same year by a significant increase in default risk for banks with a greater sovereign exposure. For instance, in the event of sovereign distress, banks with a 10 percentage point higher ratio of government debt holdings to total bank assets (relative to average bank holdings of government debt) face an expected default frequency that is, on average, 0.4 percentage point higher (Figure 2.10, panel 1, green bar). Notably, this effect is about twice as large for banks with relatively less capital (Figure 2.10, panel 1, red bar)²⁸ and is accompanied by a decline in their equity-to-assets ratio (Figure 2.10, panel 2), presumably because more exposed banks face higher funding costs that affect their profits and equity.

²⁷The sample here comprises 525 banks based in 18 emerging markets over 2000–20. The median credit default swap spread in the sample is about 250 basis points. Banks' indirect exposure to changes in sovereign stress (such as through economic growth, inflation, or exchange rate) is considered in the analysis by including country-year fixed effects. Furthermore, to address potential reverse causality concerns that sovereign distress in itself may be driven by banking sector stress, alternative definitions of sovereign distress—such as high government refinancing needs during tight global financial market conditions, or large changes in foreign-currency-denominated public debt due to currency depreciation—are also considered for robustness. See Online Annex 2.6 for details.

²⁸These effects appear meaningfully large, as the average expected default frequency in the sample is 1.2 percent.

Figure 2.10. Transmission of Sovereign Risk through the Exposure Channel

Banks with greater sovereign debt holdings and weaker balance sheets experience a higher default risk following sovereign distress ...

... as well as lower capital and lending to the private sector ...



Sources: Bloomberg Finance L.P.; Fitch Connect; IMF, World Economic Outlook database; IHS Markit; Standard & Poor's Capital IQ; and IMF staff calculations.

Note: Panels 1–4 report results from bank-level panel regressions. The dependent variable is the change in banks' expected default frequency (panel 1); change in equity to lagged total assets (panels 2 and 4, left side); change in total loans to total assets (panels 2 and 4, right side); and log change in total government debt holdings (panel 3). Balance sheet variables and expected default frequency are based on year-end data. The focus variable is the ratio of banks' holdings of government debt securities to total assets (sovereign exposure) interacted with sovereign distress (or an alternative measure of sovereign stress in panel 4) and the bank capital ratio (total-equities-to-total-assets ratio). The average effect refers to the impact of 10 percentage point higher bank sovereign exposure on the dependent variable for banks with an average capital ratio (which is close to a one standard deviation in the sample). The impact of "less-capitalized" banks corresponds to a bank capital ratio one standard deviation below the mean. Sovereign distress indicates periods when the monthly average of sovereign credit default swap spreads is higher than 500 basis points within a given year, or Standard & Poor's long-term rating for sovereign foreign exchange debt is CCC– or lower, or the government is in external or domestic default according to Harvard Business School Global Crises Data by Country. In panel 4, the valuation effect on public debt following a currency depreciation is computed by multiplying foreign-currency-denominated gross public debt in year $t-1$ by the change in the exchange rate from $t-1$ to t . The valuation effect is then normalized by total gross public debt in $t-1$. Solid bars indicate statistical significance at 10 percent or lower. See Online Annex 2.6 for further details. VIX = Chicago Board Options Exchange Volatility Index.

Banks with higher sovereign debt exposure also cut back on lending more than their peers following sovereign distress (Figure 2.10, panel 2). The reduction in lending is consistent with losses from sovereign debt exposures tightening banks' capital constraint and thus impairing their lending posture,

but it could also result from crowding-out effects, which occur when banks lend more to the government at the expense of firms and households. Empirical evidence supports this assertion: banks with an average capital ratio that are more exposed further increase their holdings of government debt

when the sovereign is in distress (Figure 2.10, panel 3).^{29,30}

The effects on default risk, bank lending, and capitalization tend to grow in magnitude as sovereign distress deepens, pointing to possible nonlinear effects. Thus, for example, the impact of sovereign distress on banks' equity is more than twice as large when sovereign spreads reach 1,000 basis points (Online Annex 2.6). The sovereign's holdings of international reserves act as a buffer, helping to dampen the severity of the shock. On average, domestic banks in countries with a higher stock of foreign exchange reserves relative to short-term external debt experience a significantly smaller decline in capital during episodes of intense sovereign stress than domestic banks in countries with less adequate reserves (Online Annex 2.6), possibly because of a smaller currency depreciation and more limited funding cost increases from unhedged foreign debt.

The analysis also considers the impact of an increase in sovereign risk associated with a tightening in global financial conditions by focusing on two alternative definitions of sovereign distress. The first is defined as a situation in which sovereign debt rollover needs are high amid significant volatility in global financial markets. The second is an episode in which public debt increases sharply following a currency depreciation. In most of these cases the impact on banks' equity and loans is significantly larger than in cases of low fiscal vulnerabilities following the external shocks (Figure 2.10, panel 4). These findings confirm the relevance of the exposure channel in emerging markets and highlight the amplification of the nexus when fiscal, financial, and external vulnerabilities are high and external financial conditions deteriorate.

²⁹Intuitively, it could be that banks are forced to hold more sovereign debt, since sovereign refinancing needs are typically higher during sovereign distress. But banks may also extend less credit to the private sector during such episodes because of weak credit demand, which is captured by including country-year effects in the regression.

³⁰The effects documented in Figure 2.10 (panels 2 and 3) are robust to defining the dependent variables as percentage changes in bank equity and lending, and the results are similar to those reported in the literature on the euro area sovereign debt crisis (Acharya and others 2018; Bofondi, Carpinelli, and Sette 2018).

Safety Net Channel

Risks to the banking sector are also intertwined with sovereign risks through the explicit and implicit guarantees, or the safety net, provided by the sovereign to banks. To assess the transmission of shocks through this channel, the analysis relies on bank-level estimates of government support called support rating floors—developed by the Fitch rating agency—which isolate potential sovereign support for banks from other sources of external support.³¹ On average, government support proxied through the support rating floors is greater in emerging markets than in advanced economies, and it has generally increased since the global financial crisis (Figure 2.11, panel 1).³²

The extent to which banks benefit from the public safety net varies across emerging markets and is importantly associated with bank-specific characteristics (Online Annex 2.7).³³ In general, there is a strong positive relationship between bank size and government support ratings, implying large implicit subsidies for banks that are “too big to fail.” In addition, banks with higher support rating floors tend to have lower capital ratios (Online Annex Figure 2.7.4, panel 2)—pointing to potential moral hazard—and a majority government stake.

This safety net provides some protection to banks and their performance in times of financial stress. However, when the sovereign itself is under stress, the perception of a weaker ability to support banks could undermine investor confidence and banks' performance. This indeed appears to be the case: the

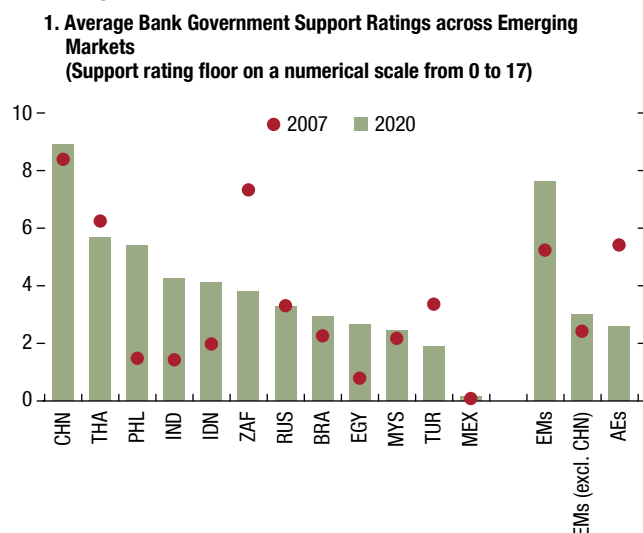
³¹The indicator reflects the Fitch rating agency's judgment of the propensity and ability of a government to provide support to a bank. Factors used to assess the support rating floor include the size and structure of the banking system, sovereign financial flexibility, resolution legislation, support stance, bank systemic importance, bank liability structure, bank ownership, policy role, guarantees, and legal status. The key advantage of this indicator is that it does not incorporate other forms of external support, such as the institutional support of the entity's shareholders. The rating also does not reflect the intrinsic credit quality of the bank.

³²The contrasting patterns between advanced economies and emerging markets may reflect different implementation stages of their regulatory reforms (for example, capital surcharges for global systemically important banks). The correlation between bank size and the support rating floor in advanced economies has diverged from that in emerging markets and has substantially receded since the end of 2015, just before the capital surcharges for global systemically important banks were phased in.

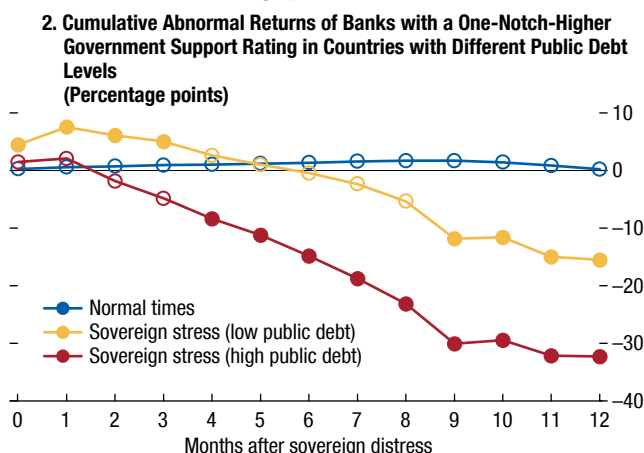
³³The distribution of government support ratings spans a wide spectrum in emerging markets, ranging from high to no support, but has changed little since 2007 (see Online Annex 2.7).

Figure 2.11. The Banking Sector Safety Net in Emerging Market Economies

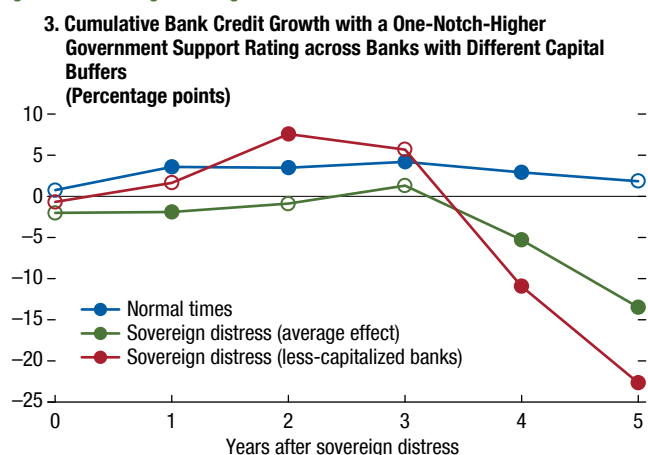
Government implicit guarantees to the banking sector have increased since the global financial crisis.



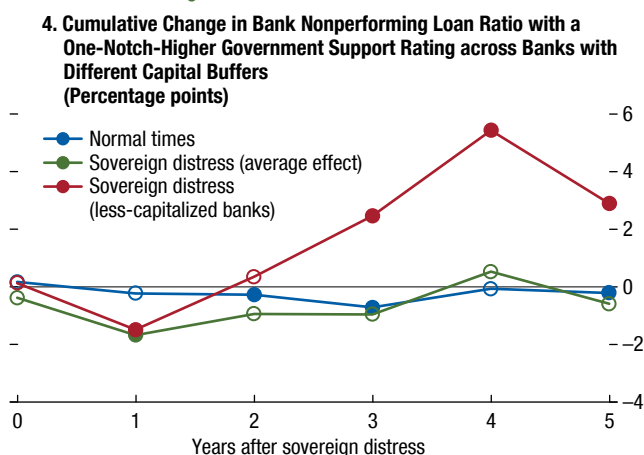
Government guarantees support banks after sovereign distress, but not so much in countries with high public debt.



Undercapitalized banks with higher implicit guarantees increase credit growth following sovereign distress ...



... leading to higher levels of nonperforming loans, suggesting increased risk-taking.



Sources: Fitch Connect; IHS Markit; Refinitiv Datastream; Standard & Poor's Capital IQ; and IMF staff calculations.

Note: Panel 1 shows the weighted average of Fitch support rating floors in major emerging markets, in which weights correspond to banks' total assets in US dollars. The support rating floor ranges from AAA to NF and is converted to a numerical scale of 1–17 (higher values correspond to a higher rating or higher likelihood of receiving government support during distress). Panel 2 shows the capital asset pricing model-based cumulative abnormal returns associated with a one-notch-higher support rating floor after sovereign distress using a local projection methodology. Sovereign distress indicates the months with average sovereign credit default swap spreads higher than 500 basis points, a Standard & Poor's long-term rating for sovereign foreign exchange debt that is CCC– or lower, or months with external or domestic debt defaults occurred. Estimated abnormal returns are shown for economies with a sovereign-debt-to-GDP ratio greater than 60 percent (“high public debt”) or lower than 60 percent (“low public debt”). Panel 3 shows cumulative bank credit growth associated with a one-notch-higher support rating floor up to five years after the sovereign distress or during normal times. The green line shows the impact after the sovereign distress for banks with an average equity-to-capital ratio, while the red line shows the cumulative impact following the same sovereign distress but for banks with an equity-to-capital ratio that is one standard deviation below average. Panel 4 shows results for a similar analysis in which the dependent variable is the cumulative increase in the bank nonperforming-loans-to-assets ratio. In panels 1–4, the analysis is based on the sample of firms with available support rating floor information. Solid dots indicate statistical significance at 10 percent or lower. Data labels use International Organization for Standardization (ISO) country codes. AEs = advanced economies; EMs = emerging markets.

equity returns of emerging market banks in times of sovereign distress are higher for banks whose support rating floor is one notch higher than that of their peers (Figure 2.11, panel 2), whereas in normal times there is no significant difference between the two groups.³⁴ However, the positive effect of higher implicit guarantees before sovereign distress declines over time, turning negative six months after the shock—potentially suggesting that the weakened sovereign strength eventually hurts the credibility of these guarantees. Accordingly, the negative effect on banks with high government support ratings starts sooner and is larger if the economy enters the distress event with a higher public debt burden (Figure 2.11, panel 2, red line).

The strength of sovereign support also matters for the ability of banks to lend following a sovereign distress event. Banks with higher government support ratings experience lower credit growth, particularly after three years (Figure 2.11, panel 3, green line), which is in line with the negative impact on bank stock returns observed after the sovereign distress event. Furthermore, banks with a higher support rating floor but lower capital expand their loan portfolios more aggressively, with cumulative credit growth about 8 percentage points higher than that of other banks two years after the distress event (Figure 2.11, panel 3). This increase in lending goes hand in hand with a worsening of bank credit quality, which suggests greater risk-taking by these banks. For example, although nonperforming loans do not seem to depend much on the level of the government support rating on average, banks with both a lower capital ratio and a higher support rating experience a significant jump in nonperforming loans in the medium term (Figure 2.11, panel 4).

Macroeconomic Channel

Empirically analyzing the macroeconomic channel—that is, the interconnectedness of sovereigns and banks through the real economy—is particularly challenging because of difficulties in isolating shocks to different sectors (Dell’Ariccia and others 2018).³⁵ For simplicity, the following analysis focuses on one component of

this channel: the transmission of risk from the sovereign to the corporate sector.

A possible empirical strategy to identify the effect of a rise in sovereign risk on firms is to exploit the uneven effect of sovereign downgrades on firms with different credit ratings. While downgrades of firms and sovereigns may both be driven by a deterioration in economic fundamentals, sovereign downgrades are more likely to cause the downgrades of highly rated firms because of rating agencies’ ceiling policies. These policies often require that firms’ ratings remain at or below the sovereign rating of their country of domicile.³⁶ This approach allows the analysis in turn to isolate the direct effect of a sovereign downgrade on firms by comparing the performance of firms subject to ceiling policies (“bound firms”—that is, those with a rating equal to or above that of the sovereign) with that of firms not subject to these policies (“unbound firms”—that is, those with a lower rating than the sovereign) under the assumption that both groups of firms are equally affected by the change in fundamentals.³⁷

The data confirm that the ratings of bound firms are more affected by sovereign downgrades than the ratings of unbound firms (Figure 2.12, panel 1).³⁸ A formal analysis of the two groups of firms following a sovereign downgrade shows that a bound firm’s cumulative investment drops nearly 17 percentage points more than an unbound firm’s cumulative investment (controlling for firm characteristics) two years after a sovereign downgrade (Figure 2.12, panel 2). Furthermore, the effect on investment is significantly larger if the sovereign downgrade is accompanied by higher sovereign stress, proxied by sovereign credit default swap spreads greater than 500 basis points (Figure 2.12, panel 3). Overall, these results are consistent with the

³⁶These policies are set after taking into account the risk of capital and foreign exchange controls, which could hamper a firm’s ability to service its debt. A similar empirical strategy is used in Almeida, Fos, and Kronlund (2016).

³⁷It is worth noting that unbound firms are by definition those with lower credit quality than bound firms. Thus, a key advantage of this empirical approach is that alternative explanations based on changes in fundamentals and credit risk are unlikely to explain the differential impact on firms’ performance around the sovereign ceiling.

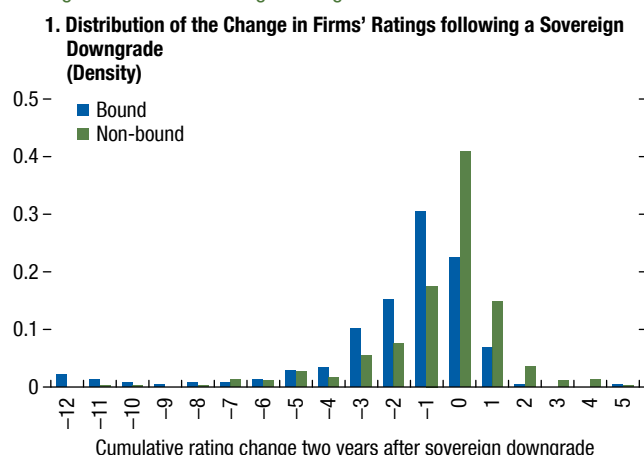
³⁸The sample is composed of 100 sovereign debt downgrades in 29 countries during 1998–2020. For each country, years with banking crises in which the country was downgraded are excluded in order to better isolate the direct real effect of sovereign downgrades (Almeida, Fos, and Kronlund 2016). See Online Annex 2.8 for further estimation details.

³⁴The sample for this analysis is composed of 10 major emerging markets covering the period 2007–20. See Online Annex 2.7 for further details of the empirical analysis.

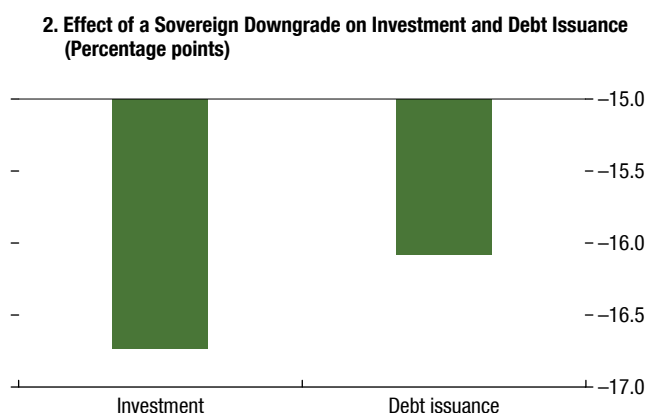
³⁵For example, sovereign and corporate riskiness may be influenced by common factors, such as a decline in economic activity.

Figure 2.12. The Effects of Sovereign Downgrades on Firms

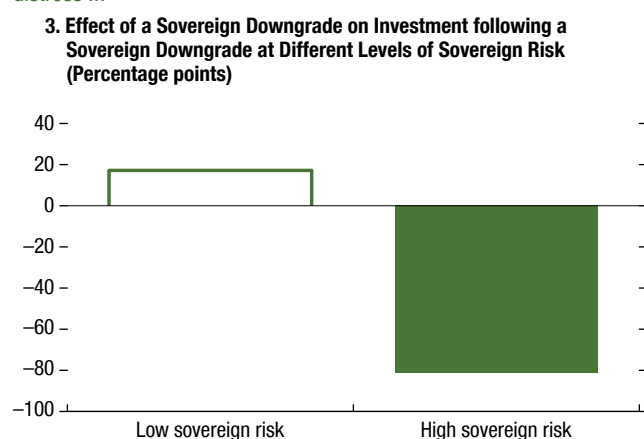
The ratings of bound firms have a higher probability of being downgraded after a sovereign downgrade ...



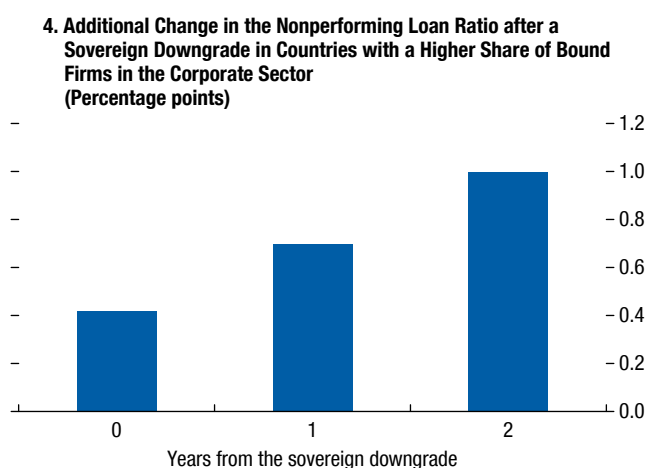
... and bound firms reduce their investment and debt issuance more than unbound firms.



The impact is larger when the downgrade is accompanied by sovereign distress ...



... and leads to spillover effects on banks' asset quality.



Sources: Haver Analytics; IHS Markit; Standard & Poor's Capital IQ; and IMF staff calculations.

Note: Panel 1 shows the distribution of the change in corporate ratings between the period before the sovereign downgrade and two years after the downgrade for "bound" and "unbound" firms. Bound firms are those with a rating equal to or above their sovereign before the downgrade. Panel 2 reports the estimates based on a difference-in-differences model comparing changes in the outcome variable between bound and unbound firms around the sovereign downgrade, in which the considered outcome variables are the changes in the firm's investment ratio and debt issuance between the period before the sovereign downgrade and two years later. The investment ratio is equal to the ratio of capital expenditure to lagged capital stock. Debt issuance is proxied by changes in the net-debt-issuance-to-asset ratio. Panel 3 shows the marginal effect of a sovereign downgrade on bound firms for different levels of sovereign risk. Low sovereign risk refers to periods with a sovereign credit default swap (CDS) spread between 250 and 500 basis points. High sovereign risk refers to periods with a sovereign CDS spread greater than 500 basis points. Panel 4 shows the cumulative effect of a one standard deviation larger share of assets of bound firms in economy-wide corporate assets on the change in banking sector nonperforming loans ratio two years after the sovereign downgrade. Estimates are based on a country-level difference-in-differences model. Solid bars indicate statistical significance at 10 percent or lower. See Online Annex 2.8 for further details of the empirical analysis.

hypothesis that firms face tighter funding constraints when directly affected by a sovereign downgrade.

The negative effects of sovereign stress on firms' borrowing costs and activity may weaken the soundness of their balance sheets. Consequently, banks' loan portfolio quality may be adversely affected, possibly leading them to curtail lending. This would further reduce consumption and investment in the domestic economy, with a consequent drop in aggregate demand and decline in the health of the corporate sector. Hence, disruptions in financial intermediation could act as an amplifier and exacerbate the damage to economic activity following a sovereign downgrade. Empirical evidence supports this intuition: following a sovereign downgrade, banks' nonperforming loans increase more in economies where bound firms play a larger role in the corporate sector, as determined by the share of their assets in total economy-wide corporate assets (Figure 2.12, panel 4).³⁹

Conclusion and Policy Recommendations

The sovereign-bank nexus has intensified in emerging markets as banks' exposure to domestic sovereign debt has increased to all-time highs. With public debt also historically high—and with the sovereign credit outlook deteriorating in many emerging markets—it is increasingly likely that a negative shock to the sovereign balance sheet may trigger an adverse feedback loop between sovereigns and banks that could threaten macro-financial stability. The analysis in this chapter shows that such a loop could occur through multiple channels, including by affecting corporate sector activity, and would be stronger in countries with higher fiscal vulnerabilities and less-well-capitalized banking systems.

Emerging markets thus face complex policy trade-offs amid tighter global financial conditions on the back of monetary policy normalization in advanced economies and heightened economic and

geopolitical uncertainty. Growth prospects are weak in several emerging markets; policy space to support the economy is limited, and borrowing constraints have tightened as foreign investor interest in local currency sovereign bond markets has dwindled and yields have risen. Policymakers must remain vigilant to emerging signs of vulnerability in the banking sector and ensure banking sector stability in the event of deteriorating credit quality.

Given the strength and multifaceted nature of the sovereign-bank nexus, policy action is required on multiple fronts. Given the heterogeneity of countries' fiscal and financial vulnerabilities, policy must be tailored to country-specific circumstances. In general, countries with stronger fiscal positions and a sound banking system will be better placed to manage tighter financial conditions. But they should seek to extend maturities of public debt where feasible and avoid a further buildup of currency mismatches to limit balance sheet vulnerabilities (see the January 2022 *World Economic Outlook Update*). In countries with limited fiscal space and tight borrowing constraints, it is imperative to (1) improve the efficiency and targeting of fiscal spending to support recovery and (2) embed fiscal policy in credible and sustainable medium-term fiscal plans to mitigate the impact of an adverse shock (see the April 2022 *Fiscal Monitor*). Some emerging markets—especially those with larger maturing debt or higher exposure to exchange rate volatility—may need to adjust faster to preserve market confidence and prevent a further intensification of the sovereign-bank nexus.

Policymakers should also seek to develop robust resolution frameworks for sovereign debt to facilitate orderly deleveraging and restructuring if needed (IMF 2020a). Domestic debt restructurings may become more frequent in the future following the increase in the share of domestic debt in total public debt in emerging markets, so a sovereign considering such restructuring should anticipate, minimize, and manage its impact on the financial system and broader economy (IMF 2021).

On the financial sector front, banks' resources should be preserved to absorb potential losses by limiting capital distribution in cases where bank profitability is difficult to assess because of regulatory flexibility. Fully assessing banking sector health remains difficult in many countries due to regulatory flexibility and forbearance. As a result, asset quality reviews may be necessary to quantify hidden losses and identify weak banks once forbearance

³⁹These findings are based on a country-level difference-in-differences regression, in which banking sector nonperforming loans across countries are regressed on the share of bound firms' assets relative to total assets of the nonfinancial corporate sector, and other control variables (see Online Annex 2.8). The results indicate that a one standard deviation higher value of this share is associated with a 1 percentage point greater change in nonperforming loans two years after the sovereign downgrade. However, these findings are only suggestive—a more direct analysis linking banks' lending behavior to their exposure to bound firms is difficult given a lack of available data.

has ceased. The results of these reviews may guide supervisory actions requiring more robust levels and quality of bank capital, which could be phased in over time in a preannounced manner to minimize procyclical effects. This is especially pertinent for countries with weak growth prospects and high corporate insolvency risks that could adversely affect financial stability should banks ultimately need to recognize loan losses. Moreover, in emerging markets with inadequate frameworks to deal with corporate bankruptcies, private debt resolution frameworks should be strengthened to prepare for the eventual withdrawal of policy support measures and minimize risks to macro-financial stability.⁴⁰

Risk to banks from sovereign exposure can materialize not just in emerging markets but also in more advanced economies, as was the case in Europe following the global financial crisis. Hence, improving transparency and data quality of banks' holdings of government debt to assess risks arising from possible sovereign distress should be a global priority. While current international standards stop short of "encouraging" banks to disclose data on all material sovereign exposures by currency denomination and account classification (BCBS 2021), market discipline will work meaningfully only if this becomes a necessary requirement for all banks. Furthermore, banks could be required to cover the risks of significant sovereign exposures in their stress tests by taking into account the multiple channels of the nexus.⁴¹

Once the economic recovery has taken hold and pandemic-related financial sector support measures have been normalized, both advanced and emerging market economies could consider introducing measures aimed at reducing incentives to hold excessive sovereign debt.^{42,43} In this regard, several reform options

have been discussed internationally in the aftermath of the global financial crisis, including the establishment of nonzero, risk-sensitive capital requirements (BCBS 2017). So far, however, no consensus has been reached to make any changes to the regulatory capital treatment of risks from sovereign exposures, although the Basel Committee could consider resuming its efforts in this regard. An alternative approach could be strict concentration limits, but these are likely to generate negative effects because banks need to hold sovereign bonds for liquidity management. Capital surcharges on bank holdings of domestic sovereign bonds above certain thresholds are more flexible and can target concentration risk if appropriately calibrated. The setting of such a surcharge should consider the liquidity needs and availability of other liquid assets in domestic currency, along with the perceived risk from excessive concentration.⁴⁴

Strengthening banking crisis management frameworks could reduce the need for government guarantees and minimize the costs of resolution to the government, including through the recovery of public funds from the industry. Some emerging markets have made much progress in this regard (Botes and others 2021). Given the economic uncertainty and the eventual unwinding of financial sector measures that have supported bank balance sheets through the pandemic, it is important to act to strengthen the financial safety net, including through deposit guarantee programs, resolution regimes, and central bank liquidity facilities. Preparing contingency plans that detail how the authorities will respond to possible future pressures is critical to support effective policy responses should an adverse scenario materialize (IMF 2020b).

Effective governance, regulation, and supervision are necessary to ensure that public banks are safe and sound while achieving their public policy objectives (IMF, forthcoming). Mitigating the risks to financial stability posed by public banks requires closing existing prudential gaps. Deposit-taking public banks directly competing with private banks should be subject to the same expectations and requirements of governance,

⁴⁰Liu, Garrido, and DeLong (2020) discuss in detail the key measures needed for effective private sector debt resolution.

⁴¹See Jobst and Oura (2019) for recent approaches to stress testing sovereign exposures.

⁴²Sovereign debt exposures could become excessive if banks are not fully pricing the risks associated with them, expecting to be bailed out in the event of sovereign distress (Dell'Ariccia and others 2018; Farhi and Tirole 2015). Furthermore, the expectation of intervention might lead to correlated risk exposures across banks as banks expect public support to be more likely in a systemic banking crisis.

⁴³In the current regulatory framework, sovereign exposures are treated more favorably than other asset classes, encouraging banks to hold sovereign bonds. The Basel Committee's standardized approach to credit risk provides a regulatory exemption that allows banks to apply zero risk weights on local currency government bonds regardless of sovereign risk. Other aspects of the regulatory framework, such as the liquidity standards, also favor the holding of sovereign debt.

⁴⁴The IMF's Financial Sector Assessment Program for Romania provides an example of systemic risk buffer calibration that aims to ensure the resilience of banks with concentrated exposures, while minimizing potential adverse impacts (IMF 2018). The framework applies a marginal scheme, with systemic risk buffer surcharges rising with the ratio of sovereign exposures to risk-weighted assets.

disclosure, regulation, and supervision as private banks. A key element of the reform agenda should be to promote mechanisms so that arm's length distance can be created between the government as the owner and the management of the bank, which can then run the bank on as much a commercial basis as possible. The government's role as an informed owner should also be separated from the supervisory authority's prudential supervision role.

Given that a lack of investor diversity can induce volatility in sovereign debt markets amid sudden changes in risk appetite, policymakers should aim to promote a deep and diversified investor base to strengthen market resilience in countries with underdeveloped local currency bond markets (IMF 2021). While domestic banks usually play a major role in emerging market and developing economies both as investors in government bonds and as intermediaries for government bond trading, a highly concentrated banking sector can undermine banks' incentives to

trade and can impede market liquidity.⁴⁵ A developed investor base should thus include a diverse range of bank and nonbank participants with different investment horizons and risk-return preferences, particularly institutional investors, to allow the government to spread risk in its debt portfolio and extend the yield curve.⁴⁶ This would also help mitigate banks' excessive exposure to the sovereign and weaken the sovereign-bank nexus.

⁴⁵Banks tend to trade securities for liquidity management purposes, which helps bolster secondary market activity. A highly concentrated banking sector can restrict market liquidity in countries with smaller financial systems.

⁴⁶Nonbank investors bring different risk-return preferences and investment horizons to the government bond market compared with banks. For example, pension funds and insurance companies generally prefer longer-dated assets to match their longer-term liabilities, largely determining the ability of the government to issue longer-dated securities and thereby facilitating the extension of the yield curve. See IMF (2021) for detailed guidance on diversifying the investor base and developing local currency bond markets in emerging market and developing economies.

Box 2.1. The Drivers of Banks' Sovereign Debt Exposure in Emerging Markets

Bank holdings of sovereign debt vary significantly across emerging markets, ranging from about 5 percent of banking sector assets (for example, in Chile and Peru) to more than 25 percent (for example, in Brazil and Pakistan) (Figure 2.1.1). In general, the exposure of emerging market banks to sovereign debt has risen since the global financial crisis, most notably in India, Indonesia, and Pakistan.

Why do banks hold government debt? Several factors may be at play, including liquidity management, expected returns, and limited alternative investment opportunities (Dell'Ariccia and others 2018). Sovereign debt offers a relatively liquid and safe asset status that may be particularly attractive in countries with weaker institutions and enforcement of creditor rights that could lower incentives for banks to lend to the private sector (Holmström and Tirole 1998). Banks may serve as market makers in government bond markets, while their government bond holdings also serve as collateral for securing funding from the central bank. The regulatory treatment of sovereign exposures—which allows banks to apply zero risk weights on local currency domestic government bonds—also makes them attractive for banks to hold. Moral suasion and risk shifting are two other potential reasons. Moral suasion refers to government pressure on banks to purchase public debt; risk shifting can occur during times of sovereign distress when banks increase their sovereign debt exposure to take advantage of higher sovereign yields.¹

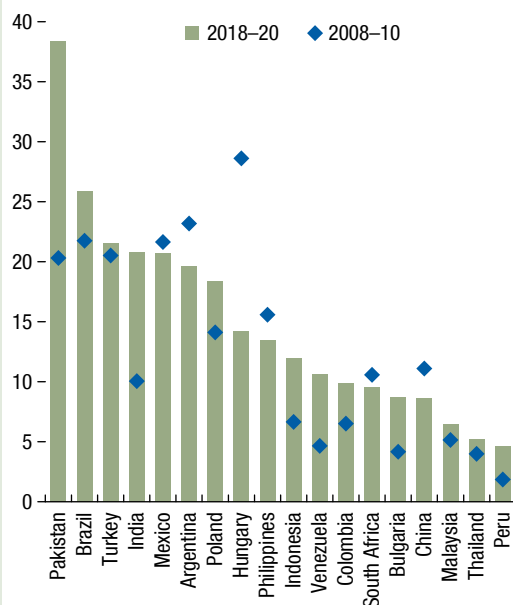
For emerging markets, empirical analysis using country-level data shows that several of the abovementioned factors are relevant (Figure 2.1.2, panel 1).² For example, banks tend to hold more government debt when interest rates are high and the sovereign is more indebted (pointing perhaps to moral suasion or risk-shifting motives) and when there are fewer opportunities to lend to the private sector, as indicated by a lower ratio of stock market capitalization to GDP, as well as a lower ratio of private sector credit to GDP.

The author of this box is Tara Iyer.

¹The flip side of this is that during sovereign distress, domestic banks could incur huge losses that wipe out their capital, leading to a banking crisis.

²See Online Annex 2.4 for a detailed description of the model, estimation method, and data used for this analysis.

Figure 2.1.1. Bank Holdings of Sovereign Debt
(Percent of total bank assets)



Sources: Fitch Connect; IMF, Monetary and Financial Statistics database; and IMF staff calculations.

Note: Given limited country-level data availability, banks' sovereign debt exposures for India and Argentina are computed using bank-level Fitch Connect data.

Further analysis using bank-level data shows that moral suasion and risk-shifting motives are indeed important in emerging markets. Domestic state-owned banks, generally dominant in emerging markets and potentially more likely to be induced to hold government debt (Ongena, Popov, and Van Horen 2019),³ purchase significantly more sovereign debt in times of high fiscal need or when the sovereign is in distress (Figure 2.1.2, panel 2).⁴ However,

³Domestic state-owned banks tend to be generally dominant in emerging markets. On average, such banks held about 30 percent of total banking sector assets in major emerging markets in 2020, but this ratio exceeded 40 percent in some countries.

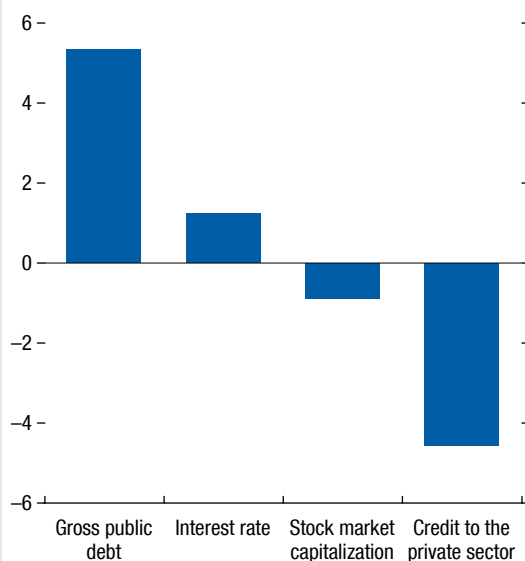
⁴High fiscal need is defined as years when maturing sovereign debt (to lagged total debt) is in the top 75th percentile of the distribution, indicating that more new public debt is likely to be issued. Sovereign distress is defined as periods when the sovereign credit default spread exceeds 500 basis points, a Standard & Poor's long-term rating for sovereign foreign currency debt CCC– or lower, or the sovereign is in external or domestic default.

Box 2.1 (continued)

Figure 2.1.2. Drivers of Bank Holdings of Sovereign Debt in Emerging Markets

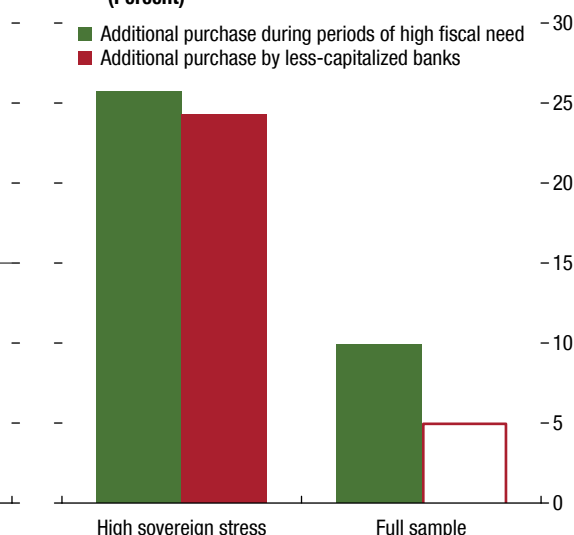
Banks hold more sovereign debt in more indebted and less financially developed economies.

1. Drivers of Bank Holdings of Sovereign Debt (Percentage points)



State-owned banks are subject to moral suasion and engage in risk shifting.

2. State-Owned Banks: Net Purchase of Sovereign Bonds during Periods of Sovereign Distress (Percent)



Sources: Bloomberg Finance L.P.; Fitch Connect; IHS Markit; IMF, Monetary and Financial Statistics and World Economic Outlook databases; Standard & Poor's Capital IQ; and IMF staff calculations.

Note: Panel 1 presents results obtained from a cross-country regression for a sample of 21 emerging markets during 2000–20. Aggregate banks' government debt holdings are computed from Fitch Connect if data from Monetary and Financial Statistics are limited. The dependent variable is banks' holdings of sovereign debt to total banking sector assets. The bars show the effect of a one standard deviation increase in the value of the regressors on changes in banks' holdings (in percentage points). Panel 2 presents regression results from a bank-level cross-country regression during 2011–20. The dependent variable is banks' net purchases of sovereign debt. (See Online Annex 2.4 for the model and estimation details.) Moral suasion is defined as the additional purchase of sovereign debt by state-owned banks in times of "high fiscal need"; that is, the years when the total amount of new debt auctioned by the sovereign (proxied by maturing debt as a share of lagged gross debt) is above the 75th percentile in the sample. Risk shifting is defined as the additional purchases of sovereign debt by less-capitalized state-owned banks, where "less capitalized" refers to an equity-to-assets ratio that is one standard deviation below the mean, which is about 7 percentage points. Solid bars indicate statistical significance at 10 percent or lower.

there is no such evidence of government pressure on private banks (Online Annex 2.4). Moreover, less-capitalized state-owned banks are more likely to purchase sovereign debt during periods of sovereign distress (Figure 2.1.2, panel 2). This pattern suggests

the presence of a moral suasion motive, but there may also be a risk-shifting strategy by these banks, whereby they are more willing to take on additional risk and improve their capital positions by purchasing high-yield debt (Acharya and others 2018).

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Chapter 3 at a Glance

- Fintech—technological innovation in financial activities—can reduce costs and frictions, increase efficiency and competition, and broaden access to financial services.
- This chapter focuses on vulnerabilities and financial stability implications of the rapid growth of fintech firms (“fintechs”), accelerated by the COVID-19 pandemic. Their fast growth into risky business segments, combined with sometimes inadequate regulation and/or supervision, gives rise to systemic risks and potential financial stability implications.
- Digital banks (“neobanks”) are growing in systemic importance in their local markets. A case study on neobanks unveils several vulnerabilities: (1) higher risk-taking in retail loan originations without appropriate provisioning and underpricing of credit risk; (2) higher risk-taking in the securities portfolio; and (3) an inadequate liquidity management framework.
- Fintech firms not only take on risks themselves but also exert pressure on incumbents. The case study of the US mortgage market presents evidence of a significant negative impact of competitive pressure from fintechs on the income of traditional banks.
- By taking innovation to a new level, a form of financial intermediation based on crypto assets, known as decentralized finance (DeFi), has had extraordinary growth in the past two years, potentially offering higher efficiency and investment opportunities. DeFi is increasingly interconnected with traditional financial intermediaries. While its market size is still relatively small, unregulated DeFi poses market, liquidity, and cyber risks, against a backdrop of legal uncertainties.
- Policies that target both fintech firms and incumbents proportionately are needed. For neobanks, more robust capital, liquidity, and operational risk-management requirements (at the entity and group levels) commensurate with their risks are desirable. For incumbents, prudential supervision may need greater focus on the health of less technologically advanced banks, as their existing business models may be less sustainable over the long term.
- The absence of centralized entities governing DeFi is a challenge for effective regulation and supervision. Regulation should focus on elements of the crypto ecosystem that enable DeFi, such as stablecoin issuers and centralized exchanges. Authorities should also encourage DeFi platforms to be subject to robust governance schemes, including industry codes and self-regulatory organizations. These entities could provide an effective conduit for regulatory oversight.

Introduction

Technological change has been reshaping banking services for years, but groundbreaking innovation and widespread adoption have accelerated this process globally. Fintech—technological innovation in financial activities—is increasingly disrupting core financial services traditionally provided by banks

The authors of this chapter are Jose Abad, Parma Bains, Yingyuan Chen, Torsten Ehlers, Antonio Garcia Pascual (chapter lead), Fabiana Melo, Junghwan Mok, Nobuyasu Sugimoto, Tomohiro Tsuruga, Zhichao Yuan, and Xingmi Zheng. The chapter was written under the guidance of Tobias Adrian, Fabio Natalucci, and Ranjit Singh.

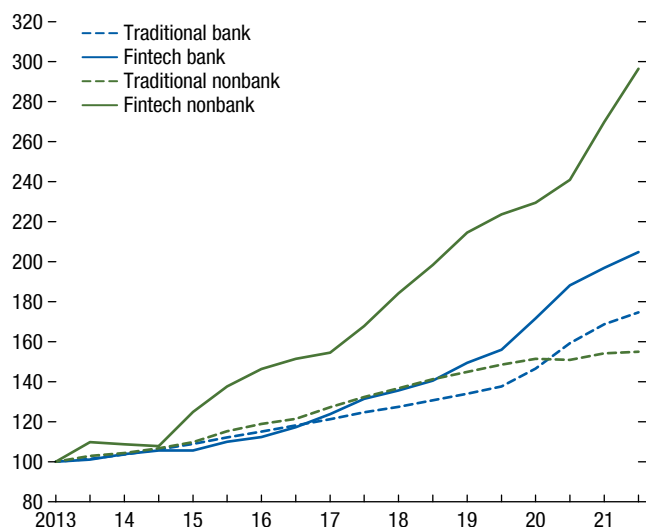
and has gained even more momentum during the COVID-19 pandemic (Figure 3.1, panel 1). At the frontier of technological advancement is decentralized finance (DeFi). DeFi is crypto-market-based financial intermediation in which all financial transactions are performed on a computer network without a central intermediary. DeFi has been growing rapidly, in tandem with the expansion of the crypto ecosystem (Figure 3.1, panel 2).

Fintech firms herald efficiency gains, progress in financial inclusion, and better customer experience (IMF 2018). Fintech firms (hereafter referred to as

Figure 3.1. The Rise of Fintech Firms and Decentralized Finance

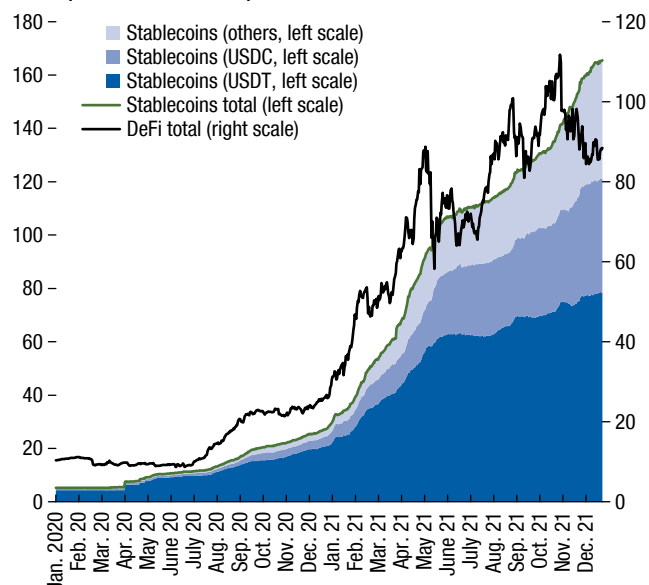
The growth of fintechs has accelerated in recent years ...

1. Growth of Assets of Fintech Lenders (2013:H1=100)



... as has the rise of assets in decentralized finance, driving growth in stablecoins.

2. Total Nominal Value of Assets in Decentralized Finance and Stablecoins (Billions of US dollars)



Sources: CoinGecko; DeFi Pulse; S&P Global Market Intelligence; and IMF staff calculations.

Note: In panel 1, the sample comprises 13 advanced economies and 7 emerging market economies. In panel 2, total nominal value of decentralized finance (DeFi) is the total value of all DeFi projects—all deposits and governance tokens held in a given platform on Ethereum blockchain as reported by DeFi Pulse. A stablecoin is a type of crypto asset that aims to maintain a stable value relative to a specified asset or a pool of assets. USDC = USD Coin; USDT = Tether.

fintechs) hold the promise of reducing costs and frictions related to informational asymmetry, increasing efficiency and competition, and broadening access to financial services, especially in low-income countries and for underserved populations. Users of fintech financial services more generally benefit from a better experience through online access to financial services on any device at any time. Taking financial innovation a step further, DeFi has experienced substantial growth in the past two years and has the potential to offer even more innovative, inclusive, and transparent financial services thanks to greater efficiency and accessibility.

The speed, reach, and depth of these changes give rise to systemic risks and pose challenges to financial stability. Fintechs are quickly making inroads into a wide range of critical financial services—sometimes aided by favorable regulatory treatment for specialized financial services. While some individual fintechs are still small, they have the ability to scale

up very rapidly—often across both riskier business segments and riskier clients than traditional lenders. The combination of fast growth and the increasing importance of fintech financial services for the functioning of financial intermediation gives rise to systemic risks. The speed and depth of such changes further pose challenges for traditional intermediaries.

In addition, DeFi often involves the buildup of leverage, and is particularly vulnerable to market, liquidity, and cyber risks as discussed in this chapter. DeFi activities are so far taking place mainly in crypto asset markets, but they can increase the interconnectedness of crypto investors. With the rapidly increasing adoption of DeFi by institutional investors, the linkages with traditional financial institutions are growing. DeFi may also accelerate the ongoing trend toward cryptoization in some economies (see Chapter 2 of the October 2021 *Global Financial Stability Report* [GFSR]).

As financial services move from regulated banks to less regulated—or even unregulated—entities and platforms, as in the case of DeFi, so do the associated risks. This poses challenges for financial authorities in the form of regulatory arbitrage, interconnectedness, and contagion that require supervisory and regulatory action, including better consumer and investor protection.

This chapter takes a deep dive into the vulnerabilities and financial stability implications of the rapid growth of fintech. It focuses on fintechs and fintech platforms (DeFi) that provide core banking services: deposit-taking and credit intermediation. While fintechs have made inroads into a broad range of financial services, deposit-taking and credit intermediation are central to both the functioning of an economy and to financial stability.¹ The chapter first lays out a conceptual framework for the different types of services provided by fintechs. It then presents two case studies of fintechs in competition with traditional banks: (1) digital banks (referred to as “neobanks”) in both advanced and emerging economies; and (2) the US mortgage origination market. The second half of the chapter focuses on lending services in the novel DeFi ecosystem, with a focus on its opportunities and risks. The chapter concludes with some policy recommendations.

Fintechs in Banking: Conceptual Framework and Risks

The core business model of banks is both to collect deposits and extend credit. In doing so, they fulfill the key economic function of financial intermediaries: the transformation of deposits (savings) into credit (investments), which entails liquidity, maturity, and credit risk transformation.

Fintechs insert themselves at various points along the financial intermediation chain, usually by providing specialized services (Figure 3.2). In doing so, fintechs can quickly develop innovative solutions that can offer efficiency gains or better customer experience.

¹Fintechs have made inroads into many other financial services, including payments, asset management, insurance, and crypto assets (Drakopoulos, Natalucci, and Papageorgiou 2021), which are beyond the scope of this chapter. Regarding data privacy concerns raised by technological developments in finance and the rise of large technological firms (big techs), the reader is referred to Haksar and others (2021).

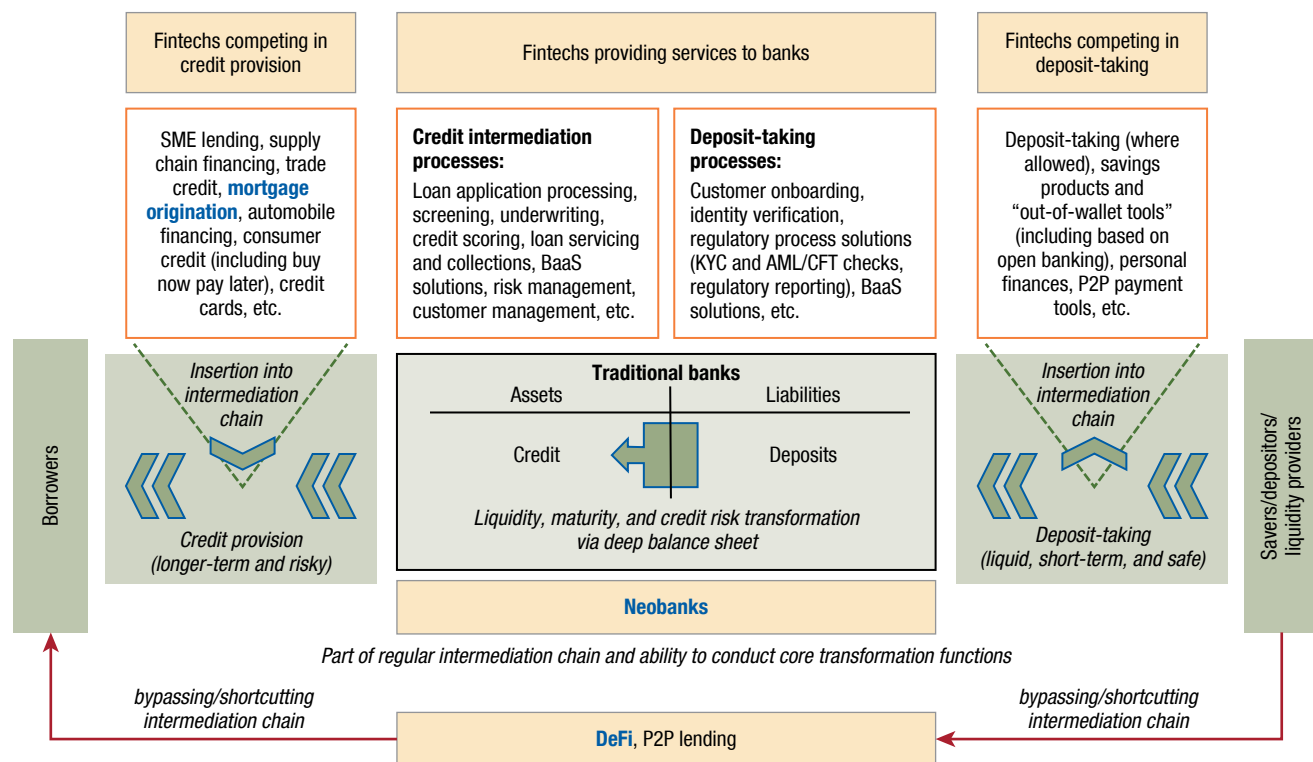
The increased competition traditional banks face from fintechs is generally beneficial from an economic point of view. Some fintechs might fall outside traditional banking regulations, as most jurisdictions allow for more lenient regulatory requirements, or can even be unregulated to some extent, as in the case of DeFi. The way in which fintechs insert themselves in the financial intermediation chain therefore has different implications for financial stability risks:

- The most common approach consists of banks cooperating with fintechs by using their services or through mergers and acquisitions. Although banks have been increasing IT-related expenditures,² using or acquiring the services of fintechs can be an effective means of technology adoption. Likewise, fintechs have been acquiring and using the services of banks. However, the use of third-party services presents challenges if they are an integral part of risk management, compliance, or fulfillment of regulatory requirements, such as “know your customer” or anti-money laundering/combating the financing of terrorism (AML/CFT). If a large number of banks rely on the same service providers, outages or cyber incidents could give rise to systemic risks.
- A more notable form of disruption arises from direct competition for the same services. Direct competition is more likely in jurisdictions where banks are less prevalent and in consumer-facing services (Boot and others 2021). In core banking services, some of the largest fintechs have grown very quickly in emerging markets—for example, Mercado Libre in Latin America, which offers a range of services, including credit to small and medium enterprises (SMEs). Direct competition in customer-facing services is lucrative for fintechs, thanks to typically higher margins than for business-to-business services.
- When fintechs provide bank-like services but operate under less stringent regulations than banks, financial stability risks can arise. The business model of fintechs relies on rapid growth, which—in the absence of appropriate regulations—can lead to excessive risk-taking, including by banks

²The largest US global bank is planning to invest \$12 billion to develop technological solutions (“JPMorgan plots ‘astounding’ \$12bn tech spend to beat fintechs” [*Financial Times*, January 15, 2022]).

Figure 3.2. Fintechs in the Core Banking Intermediation Chain

Fintechs insert themselves into the financial intermediation chain or circumvent it in the case of DeFi.



Services and institutions in blue are analyzed in this chapter

Source: IMF staff.

Note: AMF/CLT = anti-money laundering/combating the financing of terrorism; BaaS = Banking as a Service; DeFi = decentralized finance; KYC = Know Your Customer; P2P = peer to peer; SME = small and medium enterprise.

trying to defend their market position (see the case study on the US mortgage market). This can lead to capital erosion and higher systemic risk (Vives 2019).

- An important, special case of direct competition with banks is that of digital banks. They are often—but not always—fully licensed banks that compete with traditional banks across a broad range of core banking services and tend to follow a technology-driven business model with some inherent risks, as documented in the next section’s case study.
- In the most radical and disruptive approach fintechs *shortcut* the intermediation chain to remove the financial intermediary altogether. Peer-to-peer lending platforms, for instance, directly connect savers and investors with borrowers. In this case, investors commit their funds for a given time horizon and effectively assume credit and liquidity risks. In DeFi,

liquidity providers—depositors—are exposed to DeFi platforms’ run risk, while borrowers provide large amounts of collateral to eliminate credit risks (see the DeFi section later in this chapter).

Case Study: Neobanks

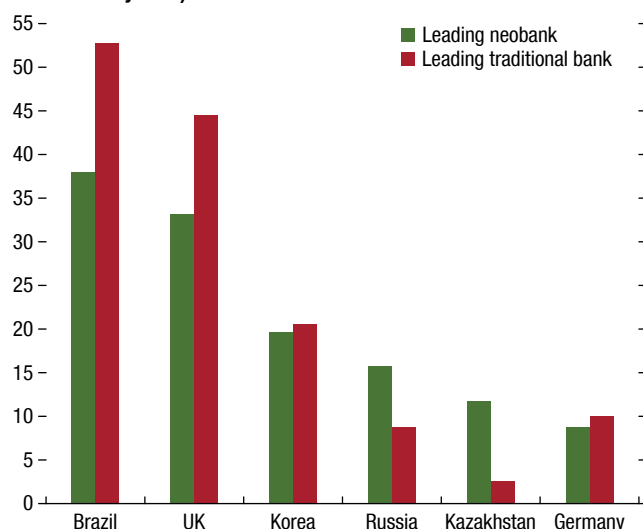
Digital banks, or *neobanks*, are direct—branchless—banks that acquire and serve customers primarily through digital touchpoints such as mobile apps.³

³This case study is based on 37 neobanks and 640 traditional banks in 18 economies. Neobanks, which have a higher-than-average risk profile (Figure 3.4), are compared against the asset-weighted average of the universe of traditional banks in their respective local markets (a measure of average bank risk). With the exception of one neobank regulated as a payment company, all other neobanks in our sample have banking licenses. Online Annex 3.1 describes both the data and methodology.

Figure 3.3. The Increasing Relevance of Neobanks

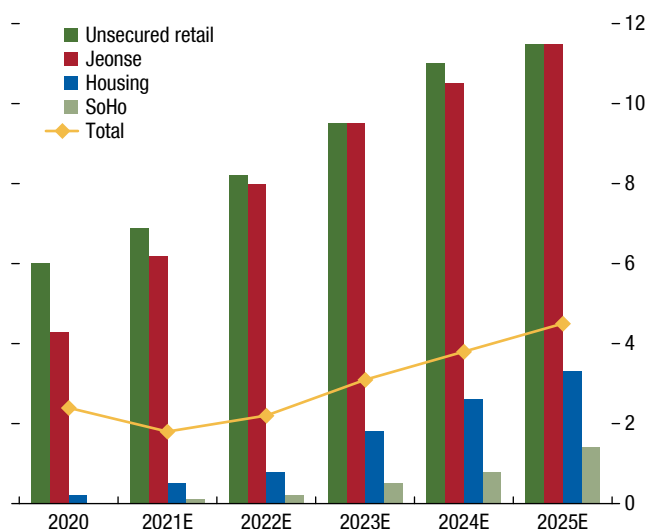
Some neobanks are among the largest players in their local markets and have large valuations ...

1. Valuation of Selected Leading Neobanks
(Billions of US dollars, as of late March 2022; for Russia: data as of January 2022)



... driven by expectations for strong loan growth, particularly in the unsecured segment.

2. Korean Digital Banks: Loan Market Share
(Percent of loans outstanding, 2021–25, expected)



Sources: Bloomberg Finance L.P.; Morgan Stanley Research; S&P Global Market Intelligence; and IMF staff calculations.

Note: Panel 1 shows the largest neobanks based on market capitalization or private valuation data. The leading traditional banks are the largest domestic banks according to assets (the second largest for Germany, Russia, and the United Kingdom). The sample of neobanks used in the case study includes the six shown above, with the exception of the UK one, for which the focus is just on its retail banking subsidiary that operates outside the UK and is significantly smaller in size (as the parent company is an e-money provider without a full banking license). In panel 2, SoHo refers to small professional businesses; Jeonse refers to special housing lease contracts in Korea. E = expected.

They aim to distinguish themselves from traditional banks through digital technologies, such as cloud computing, application programming interfaces, big data, and artificial intelligence, making banking services available on any device at any time. Neobanks tend to target financially underserved clients.

Neobanks are growing in systemic importance in their respective local markets. They have reached market capitalization nearly as large as that of some of the largest traditional banks (Figure 3.3, panel 1). Despite their currently relatively modest balance sheet size, the high valuations of some neobanks are driven by expectations for strong loan growth, particularly in the unsecured retail segment (Figure 3.3, panel 2).

Rapid scaling may be a source of value, but it may also carry higher operational risks. Rapid scaling is a key feature of neobanks, and of young firms more generally, as future growth is their main source of value. Rapid growth may also translate into the buildup of operational risks. Furthermore, evidence points to higher and increasing fraud through digital channels

(UK Finance 2021), suggesting that neobank clients may be more vulnerable to fraud than traditional bank clients.

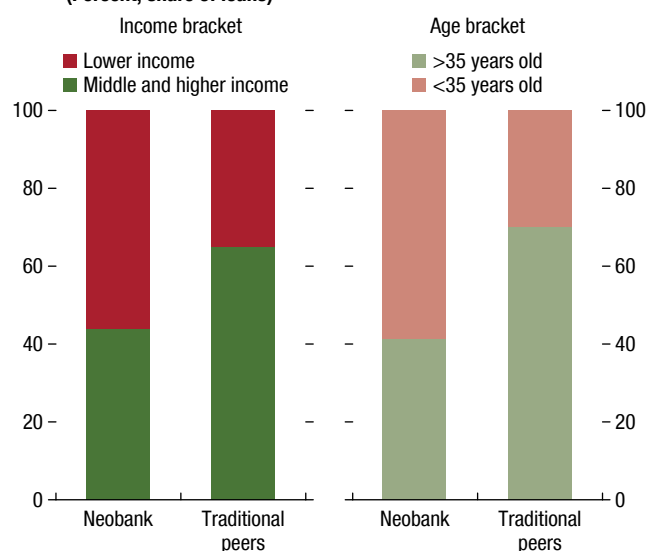
Credit Risk: High, Underprovisioned, and Underpriced

Neobanks target borrowers with a riskier credit profile. Neobanks tend to explicitly address financially underserved clients across the consumer/credit card and SME segments in the context of heavily skewed/concentrated—less diversified—loan portfolios. In practice, this means serving younger individuals⁴ with lower incomes (Figure 3.4, panel 1) and lower credit scores by granting them loans that are mostly unsecured (Figure 3.4, panel 2) or concentrated around risky sectors, such as commercial real estate (for example, SME loans by UK neobanks).

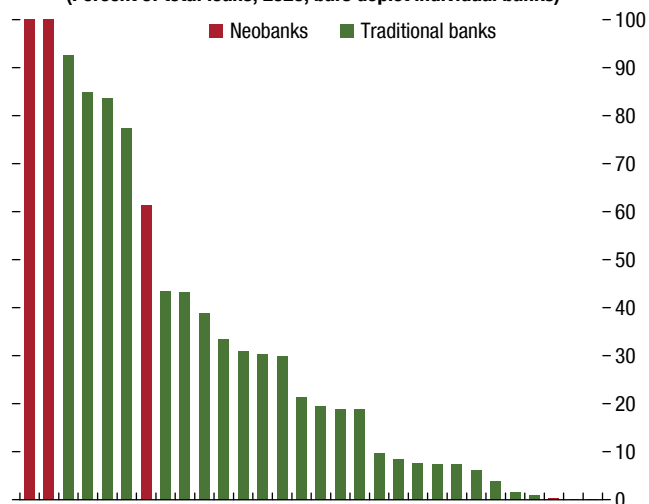
⁴While neobanks' exposure to relatively younger populations with lower incomes and credit scores poses risks, it may not only represent a higher appetite for risk but could also reflect higher technological literacy in this demographic group.

Figure 3.4. Client Profile of Neobanks

Clients are younger and have lower incomes ...

**1. Brazilian Banks: Customer Breakdown
(Percent, share of loans)**

... and there is more focus on unsecured lending.

**2. UK Banks: Unsecured Exposures
(Percent of total loans, 2020; bars depict individual banks)**

Sources: Company filings; Nu Holdings; S&P Global Market Intelligence; and IMF staff calculations.

Despite greater credit exposure, neobanks' overall credit risk coverage level remains significantly below that of traditional banks. Higher credit risk (Figure 3.5, panel 1) should translate into a higher expected loss and, in turn, into higher coverage ratios. However, neobanks' loan loss reserves as a proportion of their overall (risk-weighted) assets are well below those of traditional banks (Figure 3.5, panel 2), implying relatively looser provisioning standards or practices.⁵

Neobanks also seem to be underpricing credit risk. Neobanks feature asset yields that are typically higher than those of banks. This seems to be driven by higher yield on their securities portfolio rather than yields on their loan book, as the latter are broadly equal to those of banks. A meaningfully negative risk-adjusted net interest margin points to underpricing of credit risk in their lending business in parts of our sample as well as in some regions (Figure 3.6, panel 1). This could be due to competition vis-à-vis traditional banks and/or other neobanks. Importantly, their

risk-adjusted loan margins would be even lower if their cost of risk adequately reflected their more precarious credit-risk profile and their lower loan-related fee income were also accounted for (more on this later in the chapter). Ultimately, higher asset yields and overall net interest margins reflect an implicit cross-subsidy through neobanks' high-yielding (riskier) securities portfolios.

Liquidity Risks: Lower Liquidity Coverage Adds Risk

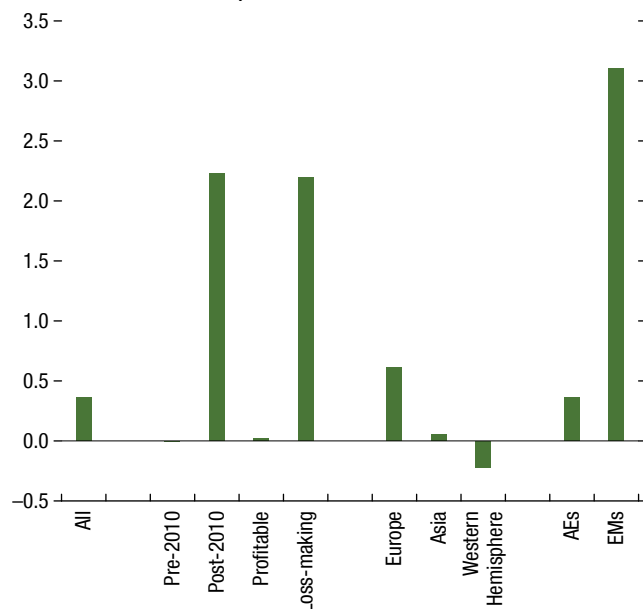
Lower liquidity coverage may pose additional risks. On the one hand, neobanks' client base is younger (Figure 3.4, panel 1) and likely to be less loyal, implying that their deposits could be less sticky. Therefore, caution would call for neobanks to operate with higher liquidity coverage ratios, in line with Basel III requirements.⁶ Instead, their ratio of liquid assets to total deposits—a measure of liquidity risk—is lower than that of banks (Figure 3.6, panel 4). On the other hand, the composition of their liquid asset portfolios shows that neobanks have a much larger share of interbank

⁵Neobanks also seem to operate with higher leverage (total equity/assets) ratios relative to traditional banks. This, however, seems related to the fact that they are young companies in their growth phase that are still loss-making for the most part (Figure 3.6, panel 3); hence they initially need higher equity. For mature neobanks, the capital advantage disappears.

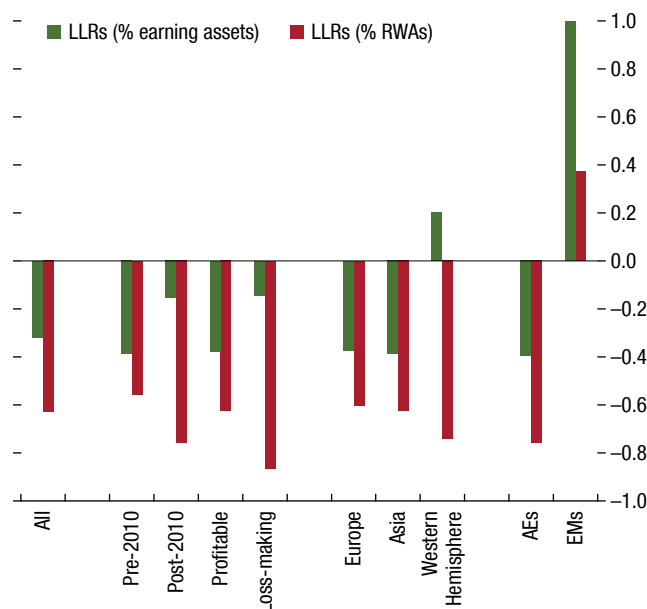
⁶For the calibration of the liquidity coverage ratio under Basel III, "less stable deposits" (including "internet deposits") are assigned a runoff rate of at least 10 percent (3 percent for "stable deposits"); supervisors may assign higher rates.

Figure 3.5. Credit Risk Profile

Neobanks have high credit costs and a riskier client base ...

1. Neobanks: Cost of Risk (CoR)
(Loan loss provisions/gross loans; in number of standard deviations vs. banks)

... but coverage falls short of traditional banks.

2. Neobanks: Coverage
(Loan loss reserves; in number of standard deviations vs. banks)

Sources: Company filings; S&P Global Market Intelligence; and IMF staff calculations.

Note: The figure panels show neobanks' distance (median number of standard deviations) from (the asset-weighted average of) traditional banks (see details in Online Annex 3.1). In panel 1, a positive (negative) number implies a higher (lower) cost of risk for neobanks compared with their respective traditional-bank peer group; the related exposures should be viewed as riskier (less risky). In panel 2, a positive (negative) number implies a higher (lower) coverage level at neobanks compared with their traditional-bank peer group, consistent with a higher (lower) expected loss. AEs = advanced economies; EMs = emerging markets; LLRs = loan loss reserves; RWAs = risk-weighted assets.

loans than traditional banks. This also suggests that neobanks are more interconnected than traditional banks with the rest of the banking system.

Weak Retail Banking Returns

Neobanks display higher operating expenses and lower potential for fee income generation. Somewhat counterintuitively, neobanks appear to be less cost-efficient than traditional banks (Figure 3.6, panel 2).⁷ This is driven by persistently higher nonstaff expenses⁸ on the back of either higher

customer acquisition costs (such as marketing)⁹ and/or higher compliance-related costs (such as those related to anti-money laundering and cyber-security). In addition, the lower income profile of neobank customers limits the potential for cross-selling insurance, wealth management, and other fee-income-generating products.¹⁰ If securities income is excluded, neobanks' margin advantage fades (Figure 3.6, panel 1). Overall, neobank returns appear weak (Figure 3.6, panel 3), with only a few neobanks generating profits.

Overall, emerging market neobanks tend to fare better than advanced economy neobanks. Emerging market neobanks display relatively lower liquidity risk than advanced economy neobanks with a stronger

⁷Our results are similar for overall operating expenses as a proportion of either total income or business volumes. Mature neobanks (defined as those established before 2010) remain more inefficient, but the difference is lower.

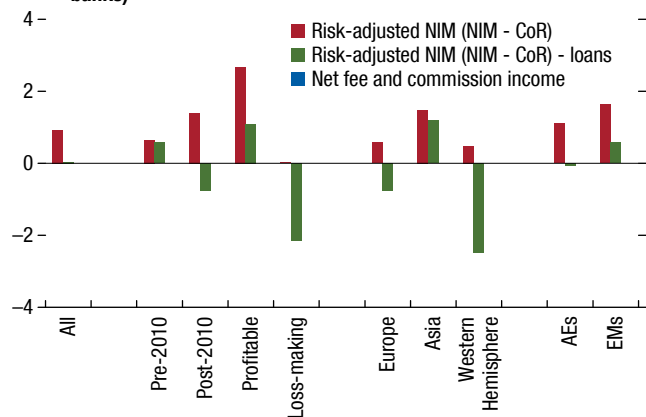
⁸Staff expenses are defined as "compensation & benefits" expenses for all (neo)banks with data available in the S&P Global Market Intelligence database. Nonstaff expenses are defined as the difference between staff and total operating expenses.

⁹These costs might constitute an initial investment needed to build up market share.

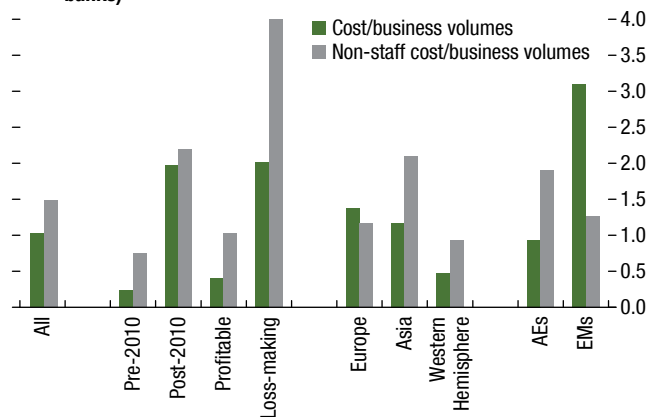
¹⁰Group-level consolidated data are used, with a few exceptions where only unconsolidated data were available.

Figure 3.6. Margins, Profitability, and Liquidity Profiles of Neobanks

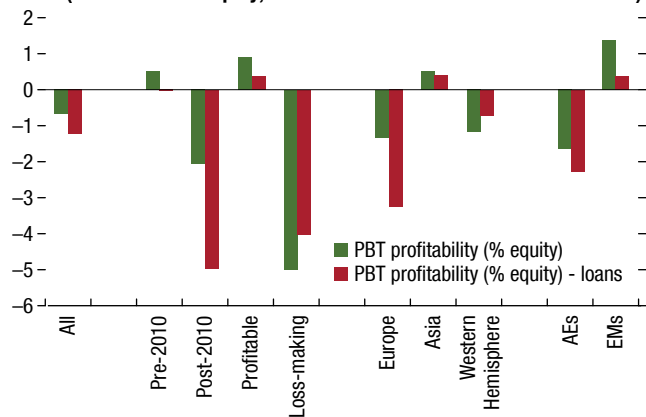
High net interest margins are driven by the securities portfolio.

1. Neobanks: Net Interest Margin (NIM)
(Percent of earning assets; in number of standard deviations vs. banks)

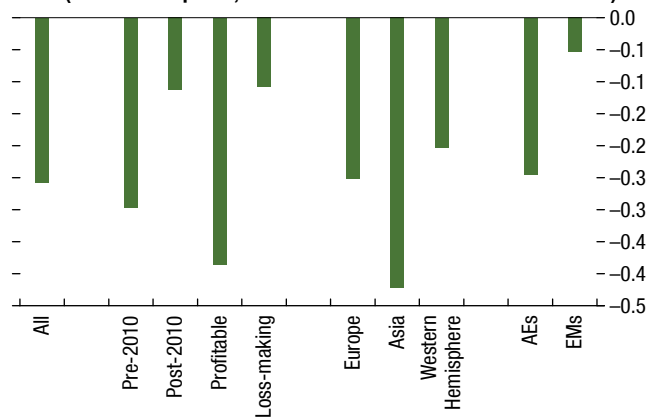
Neobanks tend to be less efficient ...

2. Neobanks: Operating Expenses
(Percent of business volumes; in number of standard deviations vs. banks)

... and have underwhelming banking returns ...

3. Neobanks: Pre-Tax Return on Equity (ROE)
(Percent of total equity; in number of standard deviations vs. banks)

... as well as weaker liquidity ratios.

4. Neobanks: Liquid Assets over Deposits
(Percent of deposits; in number of standard deviations vs. banks)

Sources: Company filings; S&P Global Market Intelligence; and IMF staff calculations.

Note: The figure panels show neobanks' distance (median number of standard deviations) from traditional banks. In panel 1, a positive (negative) number implies a larger (lower) net interest margin relative to traditional banks. In panel 2, a positive (negative) number implies lower (higher) cost efficiency relative to traditional banks. In panel 3, a positive (negative) number implies a larger (lower/negative) return on equity than at traditional banks. In panel 4, a positive (negative) number implies a higher (lower) coverage than traditional banks. AEs = advanced economies; CoR = cost of risk; EMs = emerging markets; NIM = net interest margin; PBT = profit before tax.

revenue profile and wider loan and fee margins. This seems to be related to life cycle factors (in light of the larger portion of “mature” neobanks in the emerging market subsample), but also to business models (given the relatively strong performance of Chinese neobanks).¹¹

¹¹In China, neobanks and big tech overlap, with the three Chinese neobanks in our sample backed by major local big techs.

Case Study: Fintechs in the US Home Mortgage Market

Fintechs in the US home mortgage market have been active for more than a decade. Fintechs remove the need for physical branches in mortgage origination. The main advantage of fintech mortgage originators is arguably the use of technology (Buchak and others 2018). This has afforded them efficiency gains, as they process applications about 20 percent

faster than other lenders (Fuster and others 2019). A fintech firm has been the single largest originator for several years, even though banks have continued to wield a substantial market share (Figure 3.7, panel 1).¹²

Fintechs pursue an aggressive growth strategy and serve younger and riskier borrowers. Their mortgage originations have tended to substantially outpace those of banks and other nonbanks in periods of overall market expansion (Figure 3.7, panel 2).¹³ Their ability to grow rapidly thanks to their technology and internet-based business model is highlighted by the rapid growth of recently established fintech mortgage firms. Fintech mortgages, and particularly those originated by younger fintech firms, are more popular among relatively younger borrowers, who tend to have lower incomes (Figure 3.7, panel 3). Fintechs also originated riskier mortgages with higher loan-to-value ratios during 2018–20 (Figure 3.7, panel 4). At the same time, fintechs improve access to mortgages in less affluent neighborhoods (see Online Annex 3.2, which also provides a data description and details on the empirical analyses).¹⁴

Fintechs directly compete with banks, raising financial stability challenges. Fintechs are present in all locations, including those with a higher density of bank branches (Figure 3.7, panel 5, and Online Annex 3.2). Critically, competitive pressure from fintechs—measured as the (previous period) increase in fintech market share (by mortgage origination amount) in ZIP code areas where a given bank is active—appears to have had a significant effect on banks’ interest income from mortgages (Figure 3.7, panel 6). A 1 percentage point rise in the composite market share of fintechs is associated with a 0.4 percentage point decline in (gross) mortgage interest income—this is more than 2.5 percentage points of the sample median of 16.8 percent. Importantly, expenditures by banks related to data processing (operation or purchase of IT services and software) can offset the loss of

mortgage-related income.¹⁵ This points to the importance of technology adoption for traditional banks—either through organic solutions or third-party services (these results are robust across alternative specifications; see Online Annex 3.2).

Banks have not faced full-scale disintermediation despite intense competition from fintechs. The share of mortgage assets does not seem to have been significantly affected during 2007–20. This can also be attributed to the limited role of fintechs as originators, whereas banks retained about 40 percent of the mortgages they originated on their balance sheets (Online Annex 3.2). Banks also continue to attract deposits, since fintechs in the mortgage-origination market are not deposit-taking institutions.

Decentralized Finance: Vulnerable Efficiency

Decentralized finance (DeFi) refers to financial applications—called “smart contracts”—processed by computer code on blockchains, with limited or no involvement of centralized intermediaries. Key features of DeFi are automated and decentralized record keeping, risk-taking, and decision-making within the crypto ecosystem (Table 3.1). Operations within DeFi are automated via smart contracts, and all contractual and transaction details are recorded on the network. Decisions such as changes in collateral requirements or distribution of profits are made by users with voting rights, which often accompany use of the platform. Consequently, DeFi offers broad access to players of any size and has no need for custodian service, potentially improving efficiency and financial inclusion.

Three key technological advances have contributed to the expansion of DeFi. First, the launch of blockchain technology provided a digital infrastructure to record value on a distributed system open to everyone, and in which transaction records of crypto assets are validated without the need for a single trusted entity. Blockchain is a type of distributed ledger technology.¹⁶

¹⁵The regression results shown imply that banks with IT expenditures higher by about 3.7 percent of bank equity can fully make up for the loss of income from a 1 percentage point increase in the fintech composite market share. There is, however, no evidence that IT expenditures can reduce the marginal effect of competition itself—it can only offset the effect on income.

¹⁶Distributed ledger technology enables a single, sequenced, standardized, and cryptographically secured record of activity to be safely distributed to, and acted on by, a network of varied participants. See Garrido and others (2022).

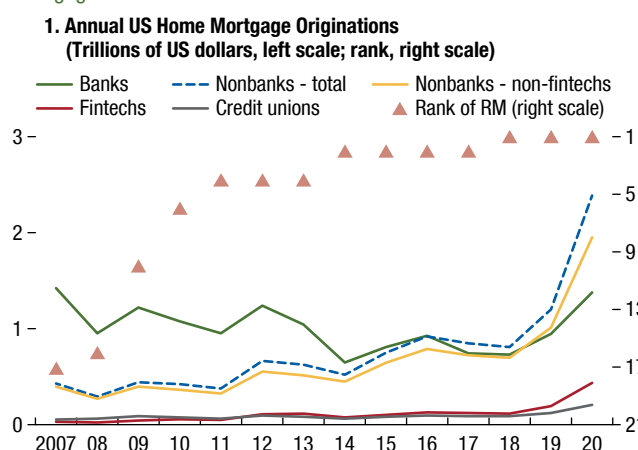
¹²The analysis uses Home Mortgage Disclosure Act data from 2007–20, covering more than 100 million US mortgage originations (see Online Annex 3.2).

¹³Nonbanks are financial institutions that do not take deposits. All fintechs are nonbanks.

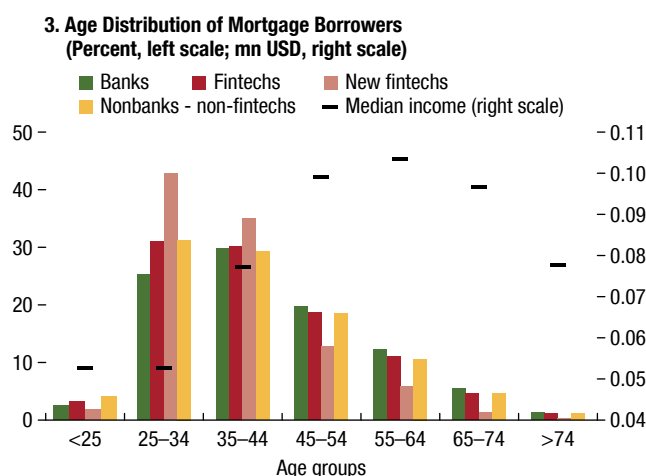
¹⁴Jagtiani, Lambie-Hanson, and Lambie-Hanson (2021) find that fintechs have high market shares in areas with low credit scores and high mortgage denial rates.

Figure 3.7. Fintechs in the US Home Mortgage Market

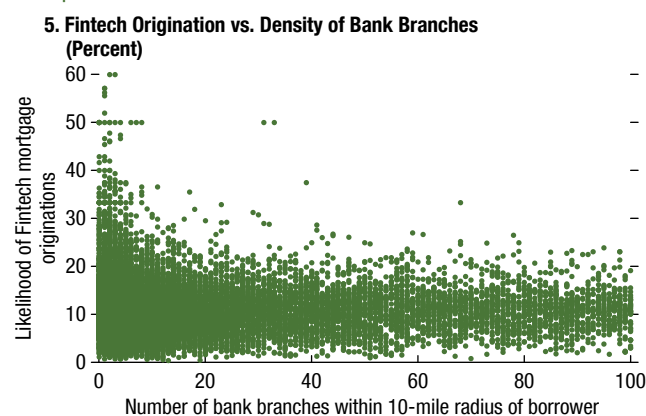
Fintechs and other nonbanks had a long-standing presence in the mortgage market.



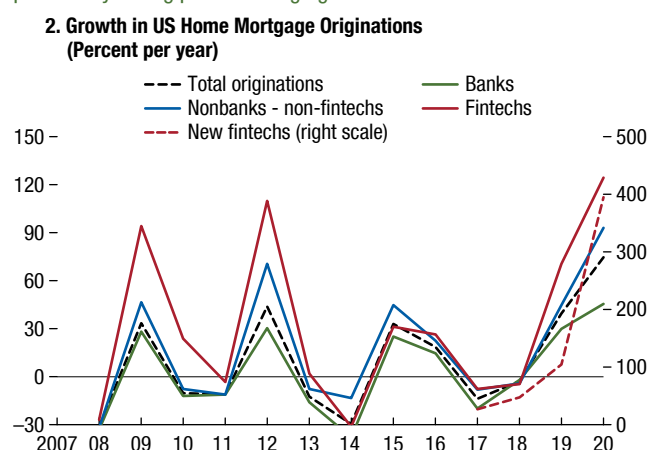
Fintechs are more prevalent among younger and lower-income borrowers.



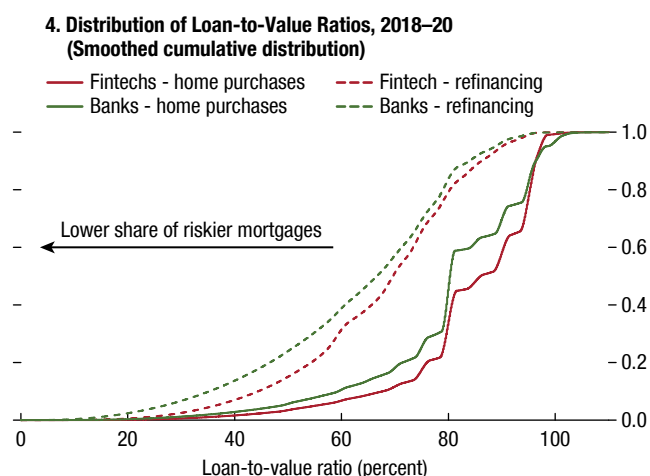
Fintech mortgage origination is only marginally lower in areas with high bank penetration.



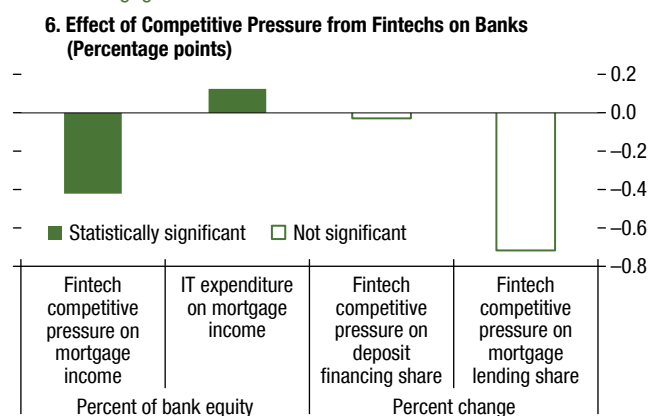
Originations by fintechs have been growing faster than banks, particularly during periods of high growth.



Fintechs have tended to originate riskier mortgages.



Competitive pressure from fintechs has had a significant effect on banks' mortgage income.



Sources: Federal Deposit Insurance Corporation; National Bureau of Economic Research ZIP Code Distance Database; US call reports; US Census Bureau; US Home Mortgage Disclosure Act; and IMF staff calculations.

Note: In panel 1, RM is Rocket Mortgage. Originations include both refinancing and new purchases of one- to four-family homes. Definitions of variables and model specifications for panel 6 are provided in Online Annex 3.2. IT = information technology.

Table 3.1. Comparison of Decentralized Finance and Traditional Financial Services

	Decentralized Finance	Traditional Financial Services
Access	World Wide Web Permissionless and anonymized	Branch office Compulsory know your customer/anti-money laundering
Operation	Automated by smart contract	Mostly manual
Instruments	Crypto assets, including stablecoins	Fiat-currency-denominated financial assets
Record keeping	Distributed ledger (verified by multiple network participants)	Centralized ledger (verified by a single trustworthy entity that operates the platform)
Decision-making	Voting by users who own governing stakes	Governed by top management (such as the bank executive board)
Risk-taking	Distributed to users	Concentrated in a single trustworthy entity

Source: IMF staff.

Second, the invention of the smart contract made it possible for blockchain technology to change the manner of financial intermediation. A smart contract is computer code that allows for transactions to be executed when certain predetermined conditions are met. DeFi is the application of smart contracts for financial intermediation such as deposit-taking, lending, derivative trading, and the exchange of crypto assets. Third, offerings of stablecoins pegged to existing sovereign currencies were a key innovation. Stablecoins are used in DeFi as a unit of account, medium of exchange, and store of value. The growth of stablecoins and evolution of DeFi have evolved in tandem (Figure 3.1, panel 2).

DeFi has the potential to offer financial services with even greater efficiency, becoming a gravitational force that attracts a large number of crypto investors. However, it may also come at the cost of greater risks and uncertainties. This section will analyze some of the key risks and opportunities of DeFi lending and discuss how authorities should prepare for it.

A Primer on DeFi Lending

DeFi has expanded rapidly, offering blockchain-based financial services in the crypto ecosystem. Among many services, the debt outstanding of DeFi lending has increased markedly since 2020, supported by the wider use of stablecoins (Figure 3.8, panel 1). DeFi provides crypto asset holders the opportunity to earn interest by depositing crypto and/or borrowing more crypto by posting collateral.

DeFi lending platforms receive crypto assets as deposits and lend them out to borrowers who meet

certain collateral criteria. A DeFi lending service works as follows:

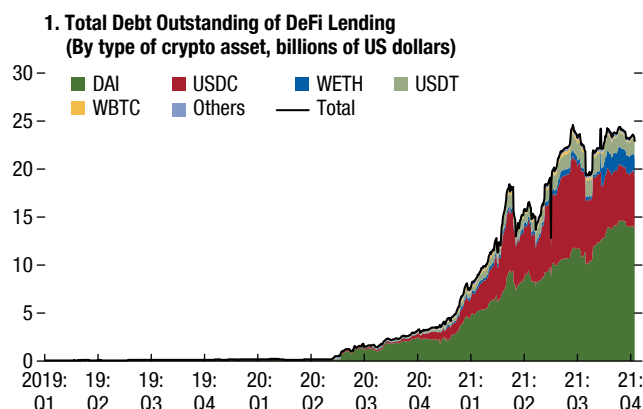
- *Deposits:* Users can earn interest by depositing their crypto asset in a “liquidity pool” specific to each type of crypto asset. Users with deposits in the same assets receive the same interest rate. In exchange, the depositor receives a platform-specific utility token that works as a certificate of deposit¹⁷ (Figure 3.8, panel 2, step 1). The token has a value equivalent to the underlying asset deposited but bears interest. A depositor can withdraw the deposit at any time (Figure 3.8, panel 2, step 2).
- *Borrowing:* A user with deposits (that is, a user who owns the utility token) can borrow a crypto asset from a liquidity pool by posting the deposited asset as collateral (Figure 3.8, panel 2, step 3). The lending interest rate varies, depending on the level of utilization for the borrowing asset.¹⁸
- *Collateral:* Collateralization is the key to safeguarding the platform from market risks associated with lending. Lending platforms often require overcollateralization by setting a discount factor (called a collateral factor) typically ranging from 0 to 0.8 across different types of assets. For example, when the collateral factor is 0.8, borrowers can borrow up to 80 percent of the collateral value posted; when a collateral factor is zero, however, as in the case of Tether (USDT) in some DeFi platforms, the user cannot borrow using the asset as collateral.

¹⁷For example, if a user deposits Ethereum (underlying asset) in a DeFi platform, such as Aave or Compound, the user will receive aETH and cETH (tokens), respectively.

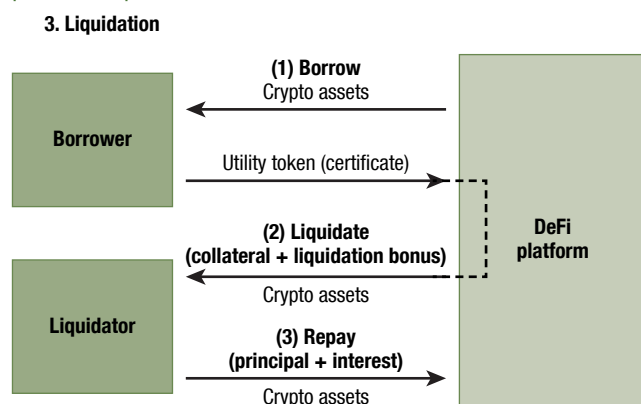
¹⁸The utilization rate of a crypto asset is the ratio of the total amount of loans to the total deposits of that asset in the platform. The lending rate is lower when the platform has more available liquidity in the deposit pool.

Figure 3.8. Recent Development of DeFi Lending

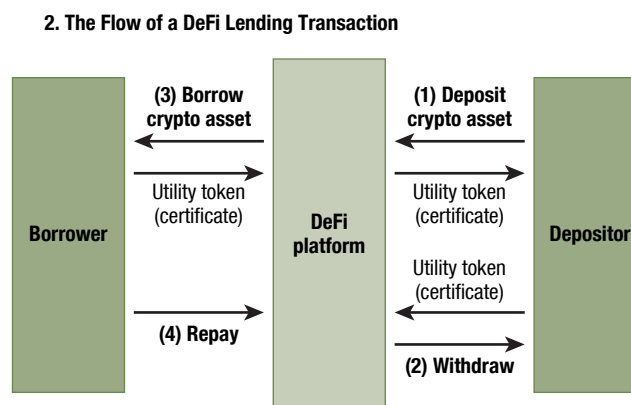
The volume of DeFi lending has increased rapidly, supported by wider use of stablecoins.



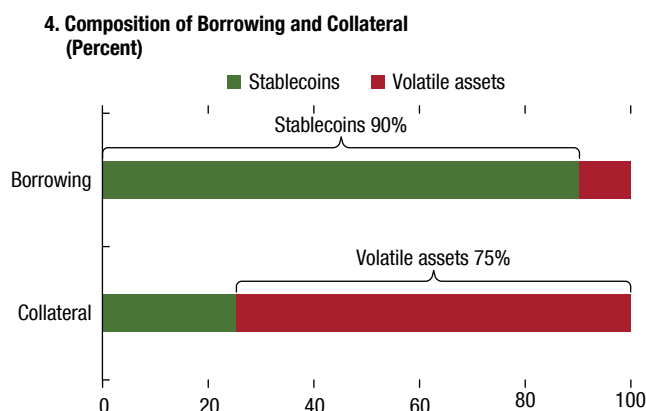
If a borrower fails to maintain the required level of collateral, the position is liquidated.



DeFi lending platforms receive crypto assets as deposits and provide collateralized loans.



Most lending is against stablecoins backed by volatile crypto assets.



Sources: Aave v2; Compound v2; C.R.E.A.M. Finance; DeFi Llama; DeFi Pulse; The Graph; and IMF staff calculations.

Note: In panel 1: DAI, USDC, USDT, WETH, and WBTC represent DAI, USD Coin, Tether, Wrapped Ethereum, and Wrapped Bitcoin, respectively. DeFi = decentralized finance.

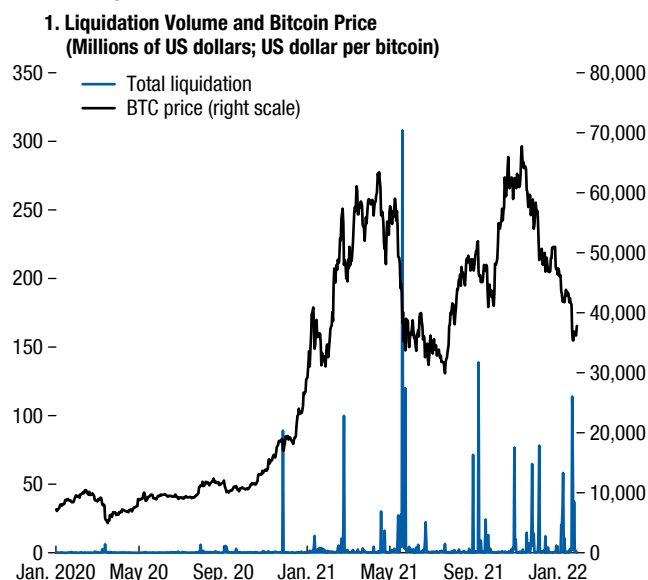
- *Repayment and liquidation:* Borrowers can repay the debt at any time (Figure 3.8, panel 2, step 4). However, borrowers must meet the collateral requirements at all times. If at any time a borrower's collateral requirement falls below the required threshold as a result of adverse price movements, liquidation can be triggered by a liquidator who repays the debt and acquires the collateral in exchange for rewards—the liquidation bonus (Figure 3.8, panel 3).

Leveraged longs and short selling are frequent strategies employed by DeFi users. The DeFi lending platform offers services that allow investors with crypto

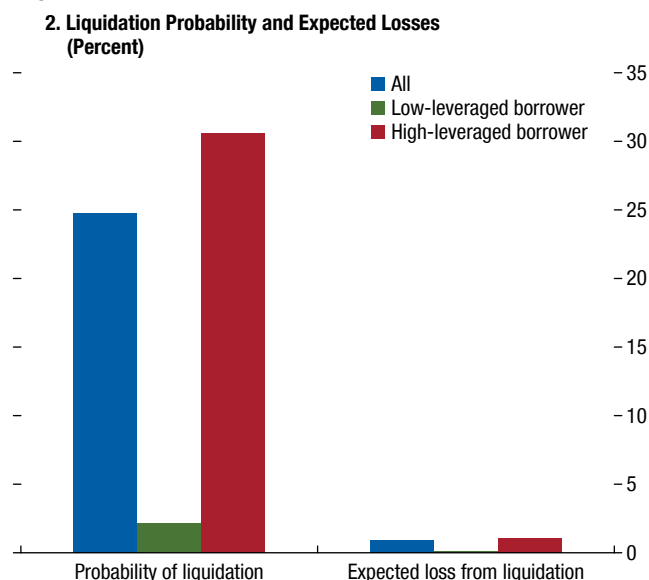
assets to borrow other crypto assets. Investors may form a *leveraged long* position (borrow stablecoins to buy risky crypto assets) or form a *short sell* position (borrow risky crypto assets and buy back later). The most typical position is to borrow stablecoins against volatile collateral. More than 90 percent of DeFi lending is denominated in stablecoins, while 75 percent of the collateral is denominated in volatile crypto assets (Figure 3.8, panel 4). As of the end of 2021, volatile crypto assets such as Ethereum and Wrapped Bitcoin were the dominant collateral. These use cases are often seen in activities such as trading and market making, which bring about higher market liquidity and efficiency, but also help build leverage and destabilize

Figure 3.9. Decentralized Finance Market Risks

High volatility of crypto asset prices leads to frequent liquidation of DeFi lending.



Lending to riskier borrowers tends to be liquidated more often with larger losses.



Sources: Aave v2; Bloomberg Finance L.P.; CoinGecko; Compound v2; C.R.E.A.M. Finance; The Graph; and IMF staff calculations.

Note: For panel 2, see Online Annex 3.3 for details on the probability and expected loss calculation. BTC = Bitcoin; DeFi = decentralized finance.

the market if used for speculation. Considering its potential and the ongoing trend toward cryptoization in some economies (see Chapter 2 of the October 2021 GFSR), DeFi lending could soon be expanded to broader financial activities, such as mortgage lending,¹⁹ consumer finance, and so on.

Similar to traditional lending, DeFi is not free from market, liquidity, credit, operational, and cyber risks. DeFi lending can incur losses under unfavorable market conditions, and liquidity mismatches can be a cause for failure to meet redemption requests. Moreover, it appears to be more vulnerable to cyber and AML/CFT risks, due to loopholes in computer code and the anonymity of the platform.

Market Risks: Vulnerable to Crypto Market Volatility

Volatile crypto asset prices lead to frequent liquidation of DeFi loans (Figure 3.9, panel 1). Liquidation is triggered when a borrower fails to maintain the collateral requirement or when the borrower's

loan-to-value ratio breaches a certain threshold. The loan-to-value ratio is marked to market and can swing considerably during volatile market conditions. Large liquidations have occurred during sharp declines in crypto asset prices. During the January 2022 crypto sell-off, liquidation across platforms surged to the highest level since May 2021, erasing \$50 billion in asset value borrowed (Figure 3.9, panel 1). When the collateral shortfall is large during periods of high market volatility, liquidation can be costly. Without timely liquidation, the shortfall will be left unaddressed and could potentially undermine platform solvency.^{20,21}

Indeed, the asset quality of DeFi lending varies considerably across assets and borrower risk profiles.

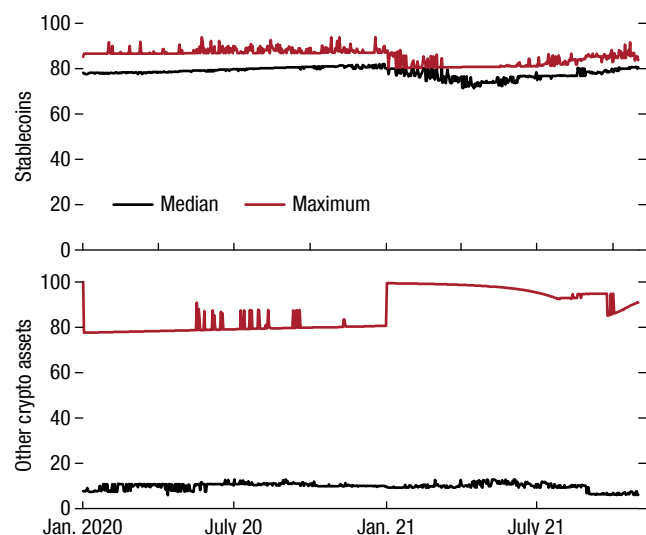
²⁰Another source of liquidation risk comes from the precision of the information source used in the platform to value its loans and collateral. If the platform is misinformed about the asset prices used in loans and collateral, it may trigger a cascade of liquidations.

²¹The deterioration of the loan quality of the platform may not materialize as a credit loss. This is because the loan has no maturity, and there are no accounting rules for provisioning or recognition of fair value loss. However, it can potentially reduce the interest.

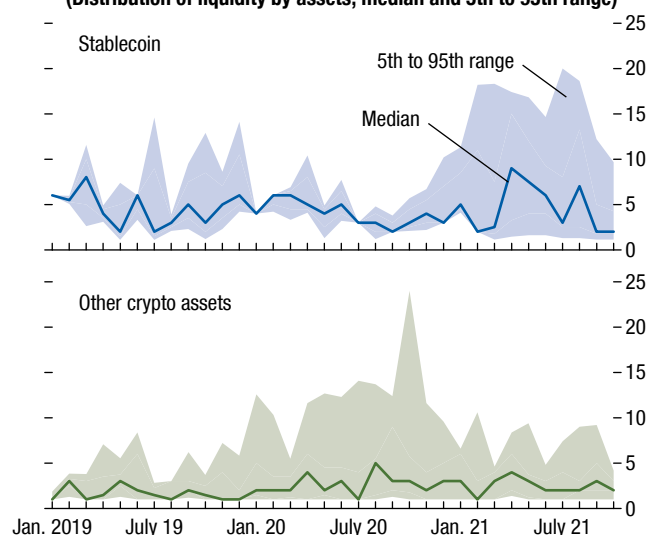
¹⁹MakerDAO, one of the largest DeFi platforms, has already started offering mortgage loans against existing real estate.

Figure 3.10. Decentralized Finance Liquidity Risks

Liquidity could become insufficient during periods of market volatility.

1. Distribution of the Utilization Rate across Assets and Platforms (Median and maximum value)

Liquidity is highly concentrated in a small number of accounts.

2. Liquidity Concentration: Number of Accounts Providing 50 Percent of Liquidity (Distribution of liquidity by assets, median and 5th to 95th range)

Sources: Aave v2; Compound v2; C.R.E.A.M. Finance; The Graph; and IMF staff calculations.

Note: The utilization rate of a crypto asset is the ratio of total loans to total deposits of that asset in the platform.

Similar to the concept of default probability in traditional loans, the *probability of liquidation* is estimated in this section through a stochastic model. Liquidation is triggered when the total value of borrowing exceeds the threshold, defined as total collateral value discounted by collateral factors (see Online Annex 3.3 for details). The modeled probability of liquidation reflects the trend and volatility of the underlying crypto assets, as well as the initial balance of debt outstanding (the leverage). The *expected loss* reflects mainly the loss of collateral value upon liquidation. The results indicate that the one-year probability of liquidation is 24 percent on average, reflecting high volatility and a rising trend in crypto prices (Figure 3.9, panel 2). In particular, riskier (highly leveraged) borrowers tend to exhibit higher liquidation probability. The expected loss is largely mitigated by overcollateralization, but still averaged about 0.9 percent, with larger losses incurred by riskier borrowers.²²

²²Even though DeFi lending is overcollateralized, the value of borrowing and repayment depends on the remaining balance of collateral relative to the debt outstanding at the time of liquidation. If the value of the borrowed token and/or collateral change abruptly, timely liquidation will fail, resulting in liquidation losses.

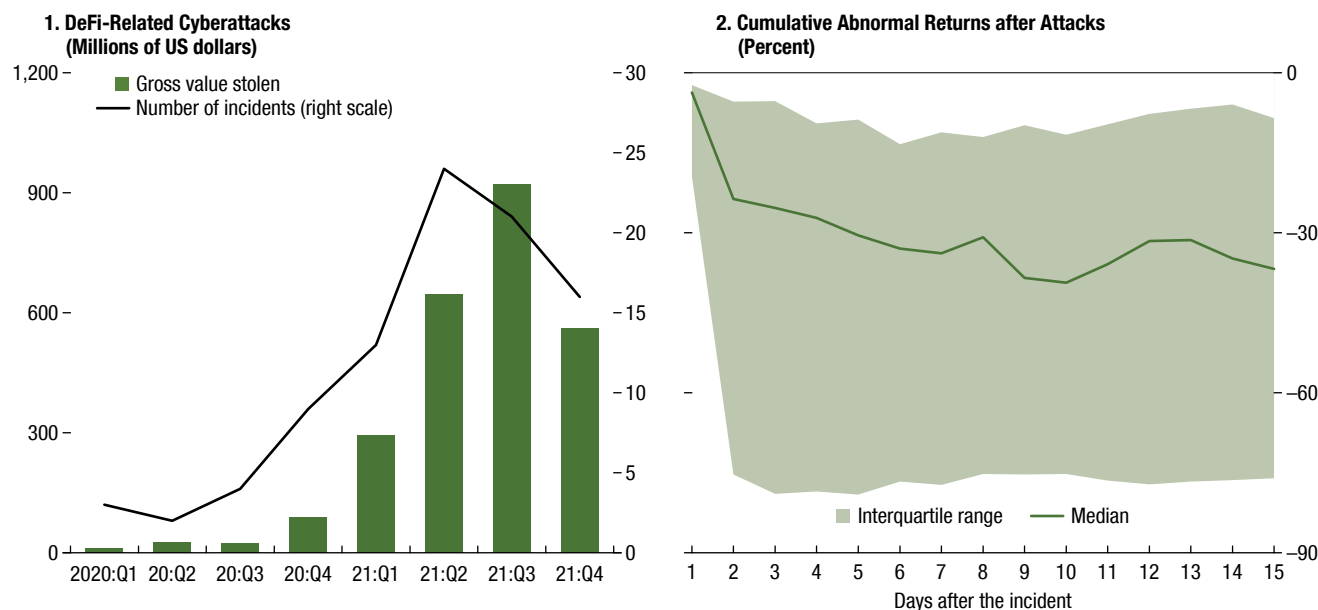
Liquidity Risks: Heavily Concentrated

Liquidity could become insufficient during periods of market stress. Depositors provide liquidity to DeFi lending platforms, which facilitates lending these deposits to borrowers. The total amount of loans that can be issued is capped by the total amount of deposited assets, or liquidity, on each platform. Similar to the loan-to-deposit ratio in traditional banking, the *utilization rate* measures how much of the liquidity for a particular crypto asset has been loaned out on each DeFi platform (Figure 3.10, panel 1).²³ When demand for borrowing a crypto asset increases, the utilization rate for its liquidity pool rises accordingly. However, a very high utilization rate could create problems for redemptions when many depositors try to withdraw at the same time. To minimize this risk, DeFi platforms set a *threshold utilization rate* above which the lending interest rate goes up steeply to discourage higher utilization. The median utilization rate is typically high for stablecoins and low for volatile assets; however, there have been instances for

²³Each DeFi platform has its own interest rate model that determines loan and deposit rates based on the utilization rate.

Figure 3.11. Cyberattacks on Decentralized Finance

The frequency and scale of cyberattacks surged in 2021 and remain elevated.



Sources: Chainalysis; CoinGecko; CryptoSec.info; DeFi Llama; Immunefi; Rekt; and IMF staff calculations.

Note: DeFi = decentralized finance.

both types of assets when utilization rates approached 100 percent during periods of market volatility (Figure 3.10, panel 1).

Liquidity provision is highly concentrated, making DeFi platforms ironically less decentralized than expected.²⁴ On average, half of the deposits are provided by fewer than 10 accounts, with even more concentrated in smaller and more volatile crypto assets (Figure 3.10, panel 2; see also Aramonte, Huang, and Schrimpf 2021; Gudgeon and others 2020). With higher concentration, an idiosyncratic withdrawal of funds by any of those large depositors can have a material impact on the liquidity condition of the platform. This, in turn, can exacerbate liquidity exhaustion, as illustrated by the occasional spikes in the utilization rate.²⁵ A more extreme outcome would be equivalent to a bank run—when participants rush to withdraw liquidity from the platform.

²⁴The liquidity providers cannot be identified due to DeFi's anonymous nature.

²⁵A spike can be triggered by other factors, such as changes in the threshold utilization rate of the interest rate model.

Cyber Risks: A Critical Risk of Decentralized Finance

Cyberattacks increased substantially in mid-2021 and remain elevated. The attacks are associated mostly with compromised wallet keys, vulnerabilities in computer code, and scams by developers (Figure 3.11, panel 1).

Cyberattacks cause large and often persistent losses. An event analysis shows a substantially adverse impact of cyberattacks on the excess growth of total value locked that represents the total value of crypto assets supplied to the platform, most of which are deposits.²⁶ The estimate suggests that, in most cases, 30 percent of the total value locked is lost or withdrawn (Figure 3.11, panel 2). Cyberattacks not only steal assets but also undermine the reputation of a platform, often triggering withdrawals by depositors as they fear not being able to redeem their deposits.²⁷ As indicated by the lower tail of the interquartile range, an entire platform can collapse in the aftermath of an attack.

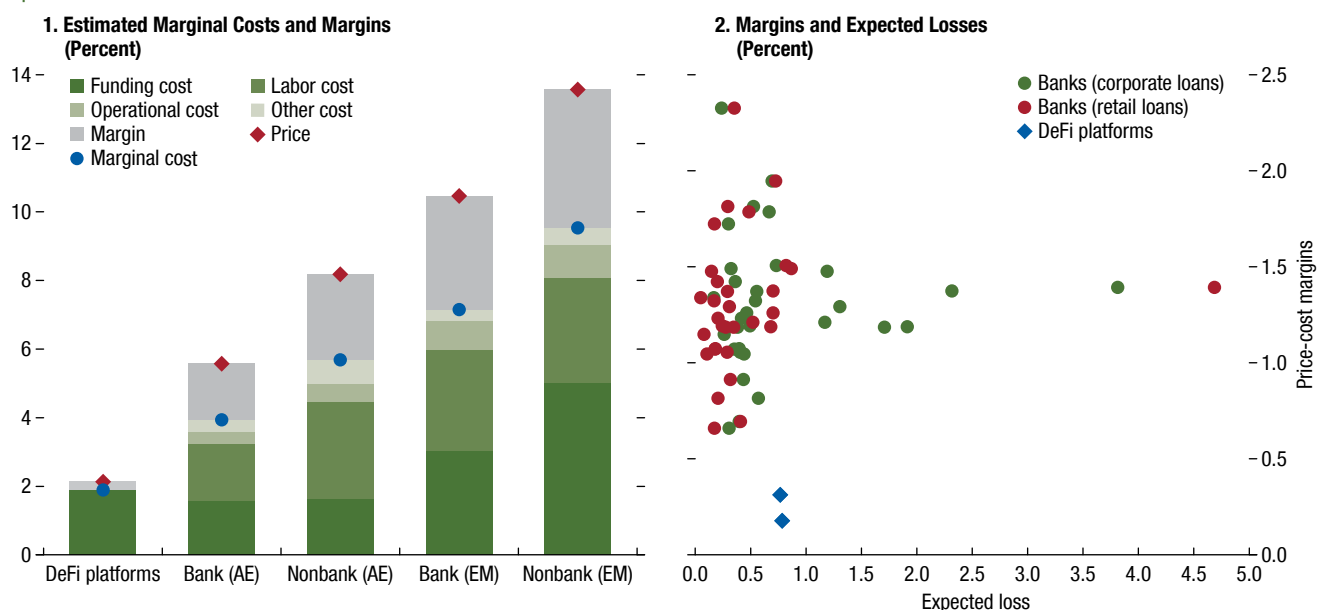
²⁶In addition to deposits, total value locked includes governance tokens (staking tokens) that are locked to the platform.

²⁷When a DeFi platform falls short of liquidity, depositors likely cannot withdraw, and they lose their assets. Deposits in DeFi platforms are not eligible for any deposit insurance or central bank liquidity support measures.

Figure 3.12. Efficiency and Risks of Decentralized Finance

DeFi has the lowest marginal costs due to the absence of labor and operational costs.

Despite high cost-efficiency, DeFi is exposed to riskier borrowers.



Sources: Aave; CoinGecko; Compound v2; European Banking Authority Risk Dashboard; Fitch Connect; and IMF staff calculations.

Note: In panel 1, the sample is composed of banks from 37 advanced economies (AEs) and 100 emerging markets (EMs); nonbanks from 20 advanced economies and 26 emerging markets; and two DeFi platforms (Aave and Compound). See Online Annex 3.4 for technical details. In panel 2, expected losses of DeFi platforms are the estimates from Figure 3.10, panel 2. Each dot represents the average expected loss for banks in a country. DeFi = decentralized finance.

Efficient but Risky

DeFi has the potential to exhibit cost-efficient financial intermediation by bypassing and shortcutting the intermediation chain. However, comparing costs and prices between DeFi and traditional financial institutions is complex because the two currently operate in different ecosystems. To address this issue, price-cost margins and marginal costs are estimated, taking into account their distinct cost structures. Following Berger, Klapper, and Turk-Ariss (2009), prices are proxied by the ratio of total revenue to total assets, and marginal costs are estimated using a panel regression model of total cost functions.²⁸ The analysis shows that DeFi has the lowest marginal cost compared with incumbents in both advanced and emerging market economies, indicating the highest cost-efficiency (Figure 3.12, panel 1). The low marginal

costs of DeFi reflect their automated and unregulated operation, which contrasts with the high share of labor and operational cost of traditional financial institutions—including (at least in part) costs related to regulatory compliance (Figure 3.12, panel 1).²⁹ However, DeFi bears high funding costs that likely reflect higher risks, such as lack of access to central bank liquidity support, AML/CFT risks, and legal and jurisdictional uncertainties.

However, DeFi's low margins raise concern about underpricing risk. DeFi margins are substantially lower than those of traditional financial institutions, offering favorable prices to borrowers (Figure 3.12, panel 1). DeFi currently must offer relatively high deposit interest rates while keeping lending margins low to attract

²⁸In the empirical approach used, liabilities are an intermediate input in the production of loans, total assets are the output, and the revenue associated with the output is interest and noninterest income. The marginal cost is defined as an incremental cost of additional loan production, and the margin is the difference between the price and marginal cost. See Online Annex 3.4 for details.

²⁹DeFi platforms can also incur episodic operational costs surrounding cyberattacks or program bugs. For example, about \$90 million was mistakenly distributed to Compound users as a result of program bugs after an update on October 1, 2021. Although the founder made a plea to users to voluntarily return the tokens, the value of tokens not retrieved would be considered a cost to the platform.

depositors and borrowers. Narrow margins are in part possible because DeFi does not have to maintain regulatory buffers. To assess margins against risk exposure, the estimated average expected losses of DeFi platforms are compared with those of banks. This comparison suggests that DeFi is significantly underpricing the riskiness of its lending (Figure 3.12, panel 2). Although lower margins can increase the popularity of DeFi, they come at a cost of thinner reserve buffers, which builds vulnerabilities during periods of market stress. At the same time, lower margins may pose significant competitive pressure to incumbents absent a (regulatory) level playing field.

Financial Stability and Policy Issues

The acceleration of digitalization in core banking services brings opportunities and risks. On the one hand, by strengthening and broadening financial development, fintechs can support more inclusive economic growth. On the other, the rapid growth of fintechs raises the risk of bank disintermediation. This is not necessarily a financial stability concern if fintechs are subject to appropriate regulatory oversight to ensure a level playing field. However, the rapid growth of fintechs does raise financial stability issues, including a potential buildup of vulnerabilities in new corners of the financial system and challenges to adapt regulatory and supervisory rules to new actors.

Regulatory Differences

Neobanks are sometimes subject to simpler and less comprehensive regulation and supervision. While neobanks in most jurisdictions are subject to banking requirements, these can be simpler than Basel III rules applicable to internationally active banks, mainly due to their current size. Conversely, in some jurisdictions neobanks operate without a banking license, some are not subject to liquidity risk requirements, and they may be subject to different loan classification and lower provisioning. Less comprehensive requirements may incentivize risk-taking in loan underwriting and securities investment.

These regulatory approaches may have been designed to be both conservative and simple for small and traditional banks. However, as the analysis in this chapter indicates, neobanks tend to be more aggressive than traditional banks in terms of loan underwriting, investment in riskier securities, and liquidity management. This suggests that although authorities may have targeted a proportional approach to regulation so as not to hinder

innovation, in practice some of this proportionality is not sufficiently risk-based to address different business models and the risk-taking appetite of neobanks.³⁰

Adapting Policies to Address Risks in Neobanks and Fintech Mortgage Firms

The rapid growth of fintechs worldwide has led to interconnectedness within the financial sector, which could exacerbate financial stability challenges. The neobank case study unveils vulnerabilities across at least four dimensions: (1) higher risk-taking in retail loan originations without appropriate provisioning and pricing standards; (2) higher risk-taking in the securities portfolio as a way to cross-subsidize their lending business in order to support its price-competitiveness vis-à-vis traditional banks; (3) potential underspending in critical functions (such as AML/CFT and IT/cybersecurity) as they fail to match market expectations for meaningful efficiency gains down the road; and (4) liquidity buffers that do not appear to be well calibrated to neobanks' less sticky retail deposit base. In addition, neobanks are providing funding to traditional banks through the interbank market. Moreover, a small number of fintech firms provide critical services (such as cloud services) to financial institutions.

Even if regulation delivers a level playing field for fintechs and incumbents, the scalability of technology-enabled business models allows fintechs to grow fast, putting pressure on incumbents. The competitive pressure on traditional banks can be significant. As the case study of the US mortgage market shows, there is strong evidence of a negative impact on banks' income as a result of competition from fintechs. Importantly, evidence also shows that banks adopting fintech-like technologies are less affected. Excessive risk-taking by both fintechs and incumbents to gain or defend market share could lead to a fast buildup of systemic risk (Vives 2019).

The rapidly changing risks in fintechs require policy action to tighten and clarify fintech regulation, as well as enhanced monitoring of incumbents, which might be more vulnerable under pressure from rapid fintech development. First, prudential regulations at both the entity and group levels should be reviewed to address fintechs' key risks in a forward-looking manner. This will likely mean more robust capital, liquidity, and operational risk-management requirements, commensurate with

³⁰Many neobanks are not subject to group-wide supervision, which creates regulatory arbitrage opportunities.

the risk taken by neobanks in several jurisdictions. Second, the health of technology laggards and smaller banks could be particularly at risk as they may not have the resources and know-how to adapt to technological changes. This may require supervisors to closely monitor less technologically advanced incumbents.

Regulating Decentralized Finance

DeFi poses unique challenges to regulators. DeFi's elevated market, liquidity, and cyber risks may need adjustment to the regulatory perimeter, but DeFi's anonymity, lack of a centralized governance body, and legal uncertainties render the traditional approach to regulation ineffective.

As DeFi, stablecoins, and traditional financial entities have grown ever more interconnected, enhanced regulatory surveillance and globally consistent regulatory frameworks will be necessary. Stablecoins are backed or collateralized by cash and financial instruments, and regulated financial institutions are increasing their exposure to and funding from stablecoins (Aramonte, Huang, and Schrimpf 2021). This linkage can lead to stronger interconnectedness between DeFi and the financial sector. Basel Committee on Banking Supervision (BCBS) proposals on banks' crypto asset exposures are a significant step toward global standards to help address some cross-border issues.³¹

As a first step, regulation should focus on some elements of the crypto ecosystem that have enabled the development of DeFi. These include stablecoin issuers (which define technical specification and use cases); centralized crypto exchanges and hosted wallet service providers (which connect crypto markets with the broader financial system); and reserve managers, network administrators, and market makers (which play important roles in operationalization and stability). These entities would benefit from robust and comprehensive national regulatory frameworks delivered through common global standards by standard-setting bodies. Those centralized entities in the crypto asset ecosystem could be an effective liaison for regulators to address the risk of rapid DeFi growth.

³¹In 2021, the BCBS consulted on a preliminary proposal for a prudential treatment of banks' crypto asset exposures. The proposed standards reflect the high risk of some crypto assets, while taking a more proportional approach to those that are anchored on real-world assets. After this initial public consultation, the Committee has reviewed the comments received and is now working to further specify a proposed prudential treatment, with a view to issuing a further consultative paper by mid-2022.

As a second step, authorities can directly regulate key functions within DeFi. To manage the risks generated by protocol developers, measures could include public-private collaboration on code regulation through either ex ante guidelines on operational and risk parameters (including operational and cyber resilience) or ex post code reviews and audits that can identify areas vulnerable to risk and help deliver policy objectives. Ex ante measures can be combined with greater disclosure and user education to help identify platform-specific risks, closing the information gap between retail and institutional investors.

Authorities should encourage DeFi platforms to adopt robust governance through industry codes and build effective public-private collaboration to establish self-regulatory organizations. A transparent and credible governance system could improve risk management, facilitate good conduct of financial transactions, and eventually attract more users and capital to the platforms. Such a governance system could be a natural entry point for regulators to interact either directly or through the development of industry codes or self-regulatory organizations. For example, their governance token holders can form decentralized autonomous organizations with voting rights, like traditional securities.³² These organizations may provide authorities with a conduit for regulatory oversight, ensuring that DeFi platforms enhance disclosure and have suitable controls. Much as in traditional securities markets, self-regulatory organizations for centralized crypto exchanges would lead to more robust listing standards for (tokens of) DeFi platforms and thereby improve their governance and quality. Regulators should monitor the effectiveness of industry codes and self-regulation and enhance supervision intensity when necessary.

Enforcing regulations—including restrictions—in DeFi markets is challenging, as experience from crypto markets shows.³³ One potential approach is to restrict the exposure of regulated firms to DeFi markets (especially markets not subject to proper regulation or self-regulation), which could slow the pace of growth while addressing the risks of interconnectedness with regulated markets.

³²In some jurisdictions, such as the state of Wyoming in the United States, decentralized autonomous organizations are considered legal entities.

³³Despite the implementation of restrictions, an estimated 1.7 million Egyptians hold crypto assets (TripleA 2022). Many crypto asset service providers operate offshore; users can take advantage of virtual private networks to obscure their location, demonstrating the difficulty in enforcing regulations.

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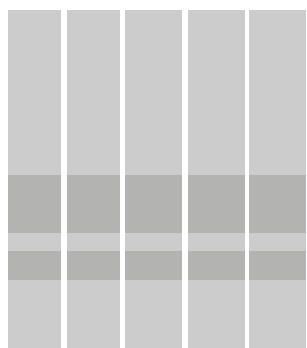
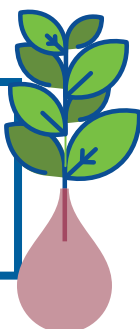


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