

Chapter 3. Acting on Climate Risks and Climate Finance through the Banking Sector

Climate-related risks in the financial sector and large climate financing gaps pose a dual challenge for banking authorities in EMDEs. Climate risks, if not addressed, could significantly reduce output in EMDEs; they also present risks to financial stability and may adversely interact with other financial sector challenges such as those discussed in previous chapters. EMDEs also face a significant gap in climate financing: excluding China, they represent about 25 percent of global output but account for just 14 percent of global climate finance flows, with more than 50 percent stemming from public sources. Only 16 percent of climate financing in EMDEs (ex China) goes to adaptation, nearly all of it stemming from public sources (98 percent). Moreover, while advanced economies and China can rely on domestic sources for over 90 percent of their climate finance, in EMDEs (ex China) less than half of climate finance is domestic in origin. Moreover, 28 percent of EMDE banks provide no climate financing at all, and for 60 percent of EMDE banks climate finance accounts for 5 percent or less of their lending portfolios.

EMDE banking authorities are addressing the climate risks specific to their financial sectors in innovative ways. EMDE banking authorities are adopting climate risk management tools and developing supervisory approaches. In doing so, they should mitigate any unintended consequences for financial inclusion. Most progress to date has been in middle-income EMDEs, where banking authorities are proactively strengthening their approaches to climate risk by deploying these regulatory tools in a sequenced, proportional, and innovative manner. Risks to nature are also starting to be assessed, which is important for EMDEs given their extensive adaptation needs.

EMDE banking authorities are also enabling climate finance and need guidance on how to do so without compromising their primary financial stability objective. Banking authorities globally are testing new approaches to promoting climate finance. These approaches range from adjusting interest rates on lending facilities to requiring banks to direct lending to green activities. Most of these are relatively new and empirical evidence about their suitability and effectiveness, as well as their potential to interfere with primary financial stability mandates, is still emerging. Some efforts, such as a well-designed post-disaster regulatory response, can encourage lending and enhance climate resilience. For other approaches, such as providing preferential interest rates to commercial banks for on-lending to designated green sectors, the “jury is still out.” Other tools such as directed

lending have been deployed for different purposes in the past with limited success and are currently not recommended for mobilizing climate finance.

To meet the dual challenges of climate risk management and climate finance mobilization, banking authorities need to continue addressing gaps and strengthening coordination regarding data, modeling methodologies, taxonomies, and disclosure standards. Such interventions are fundamental to improving climate risk management and raising investment levels. Adoption of green and sustainable taxonomies, which define and classify investments and activities that support climate targets, will be essential, yet today they cover only 10 percent of EMDEs compared with 76 percent of advanced economies.

Though banking authorities have an important role to play given the dominance of the banking sector in EMDEs, closing the climate financing gap requires broader policy support and financing from beyond the banking sector. Some governments look to central banks and banking authorities for support, but they should not infringe on these institutions' operational independence. Moreover, prudential or central bank measures should not interfere with institutional core mandates and cannot substitute for necessary broader government interventions when tackling climate change, including carbon pricing, fiscal policies, and sectoral regulations. Challenges related to climate finance are often symptomatic of broader issues with mobilizing development finance in EMDEs. This is partly due to the absence of well-functioning capital and insurance markets in many EMDEs; such markets need to be developed to provide access to long-term funding for new green technologies as well as critical climate infrastructure and climate risk resilience instruments. Institutions such as national development banks – which have \$19 trillion in assets – and credit guarantee institutions can play a major part in raising more climate finance if deployed judiciously and in a targeted fashion.

Banking Authorities Face Dual Climate Challenges

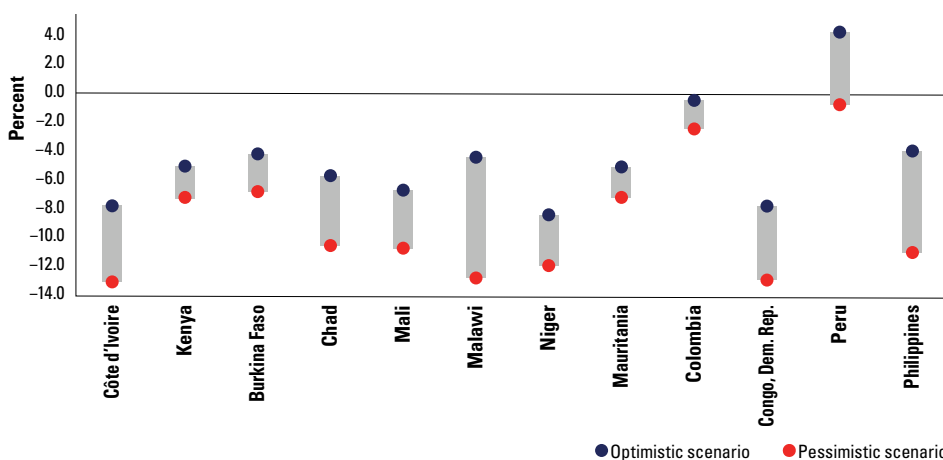
Banking authorities in EMDEs have a pivotal role in strengthening the banking sector's capacity to finance climate action and build resilience against shocks related to climate change.⁶⁶ In line with their primary mandate of financial stability, these authorities are progressively encouraging and guiding the management of climate-related financial risks. A number of EMDE banking authorities are also taking action to facilitate climate finance, some of them motivated by explicit development mandates (which around one-half of EMDE authorities have), support and encouragement from their governments, or both. If done well, achieving these goals can be reinforcing, as investing in low-carbon activities should reduce climate-related financial risks. At the same time, care needs to be taken to avoid unintended consequences for financial stability and inclusion.

Climate change poses particularly high economic risks for EMDEs. Climate change is projected to have a significant impact on economic opportunities and development outcomes in EMDEs. As with the overall financial risk outlook outlined in chapter 1, the impact of climate risks is likely to be particularly severe in low-income countries. According to analysis from World Bank Country Climate and Development Reports (CCDRs) (World Bank 2023a) unmitigated climate change could reduce GDP by more than 12 percent by 2050 against a baseline scenario (figure 3.1, panel a). Despite remaining uncertainty, the impact on EMDEs is consistently projected to be considerably larger than on advanced economies (Kahn et al. 2019).

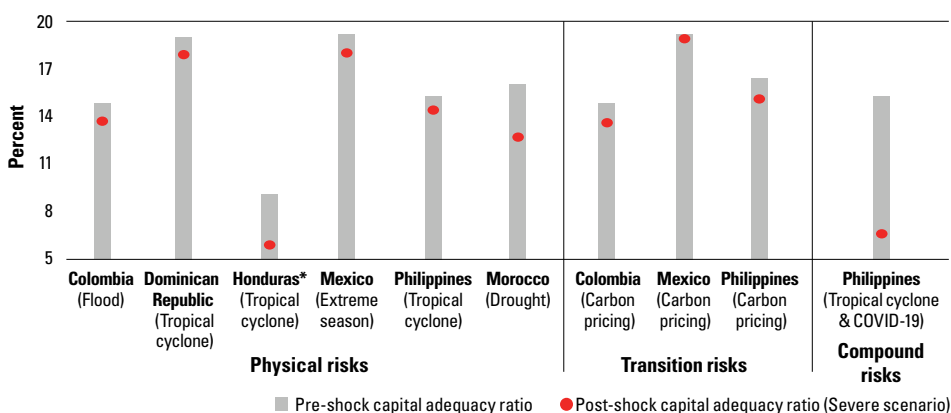
The extent to which these risks affect financial sectors varies widely between countries and individual financial institutions. Global standard-setting bodies and national banking and financial sector authorities acknowledge that climate change poses significant physical and transition risks to the financial sector overall, including the banking sector.⁶⁷ While substantial differences exist between EMDEs, they are generally thought to be disproportionately more exposed to the physical risks from climate change. Transition risks are particularly relevant for middle-income countries with high greenhouse gas emissions and EMDEs reliant on exporting primary products, including fossil fuels. A World Bank review of climate stress tests shows that, although overall financial stability impacts appear to be manageable (figure 3.1, panel b), the resilience of individual banks can differ markedly, potentially undermining their financial health. For instance, stress tests in Colombia, Morocco, and Mexico indicate that overall physical risks such as droughts and floods, as well as transition risks, are relatively benign for the financial system as a whole (Reinders et al. 2021; World Bank 2024; IMF 2022). However, the projected impact on Mexican banks' capital adequacy ratios from extreme weather events ranges from 0.5 percent to a substantial 4 percent.

FIGURE 3.1 Limits to Current Stress-Testing Methodologies May Underestimate the Impact of Climate Risk on Banks' Capital Despite Significant Impact on EMDEs

a. Climate change impact on gross domestic product (GDP) in 2050 under pessimistic and optimistic scenarios for selected EMDE countries against a baseline scenario (percent of real GDP)



b. Climate stress test results as impact on system-wide capital adequacy ratio for different scenarios, selected countries (pre- and post-shock banking system capital ratio in percentages)



Sources: a: World Bank 2023a. b: World Bank staff calculation based on publicly available climate risk assessments across six EMDEs (Reinders et al. 2021; Banco Central de la República Dominicana 2022; World Bank 2023c; IMF 2022; Hallegatte et al. 2022; Nie et al. 2024).

Note: Panel a: The bars indicate the range of economic impacts of climate change with current policies and practices, with recommended adaptation measures (optimistic scenario—blue dot) and without those measures (pessimistic scenario—red dot). Panel b: The graph shows the outcomes of the most severe physical or transition risk scenario per country. The year of assessment for these studies varies from 2022 to 2050. * The analysis shows the impact on banking system-wide capital adequacy ratio (CAR), except for Honduras, where it indicates CET1 ratio impacts. CET1 = common equity tier 1; EMDEs = emerging market and developing economies; GDP = gross domestic product.

Current climate risk assessments cover only a subset of climate transmission channels and thus may underestimate the effects on the economy and financial sector, which prevents proper risk pricing. The view that climate risks currently appear manageable might also stem from the fact that assessment methodologies of climate impacts are still in their early stages, face data gaps, and have a limited set of direct transmission channels. They also lack insights into critical uncertainties, including climate and ecological tipping points, compound risks and adverse feedback loops (see box 3.1), and the impacts of a disorderly transition.⁶⁸ These problems in climate impact models can lead to underestimating and mispricing the severity of climate events (Stern, Stiglitz, and Taylor 2022; Stern and Stiglitz 2023) and undervaluing the advantages of mitigation and adaptation strategies (Köberle et al. 2021; Ekins and Zenghelis 2021).

Box 3.1 Compound Shocks and Adverse Feedback Loops

Compounding effects of multiple shocks and feedback loops could significantly increase climate impacts, yet they are currently not considered in most climate-risk assessments. Climate risks do not occur in isolation. In EMDEs in particular, climate risks are often compounded by challenges arising from an already vulnerable population, weak institutional capacity, and macrofinancial risks.

Compound shocks may emanate from a range of sources, including multiple climate-related risks as well as other environmental, economic, societal, geopolitical, and technological risks. For example, countries may experience sequences of multiple climate-related shocks that erode their resilience, such as clusters of tropical cyclones during a single season (Dolk, Laliotis, and Lamichhane 2023), or instances where a climate-related shock occurs during another crisis (Ranger, Mahul, and Monasterolo 2022).

Climate-related risks may also adversely interact with macrofinancial risks such as those described in chapters 1 and 2 (also see Feyen et al. 2020). For instance, a climate shock could significantly damage the balance sheets of financial institutions resulting in financial stress or even a crisis, particularly in countries that already face high financial sector risks. Moreover, a climate shock could, at the same time, weaken a country's fiscal position by requiring additional spending and debt issuance to finance aid and recovery efforts. This situation could produce adverse feedback loops between the financial sector and the sovereign, particularly when the sovereign-bank nexus is strong and the institutional capacity to deal with financial stress is weak.

The impact of compounded shocks in EMDEs can be substantially larger than the sum of the

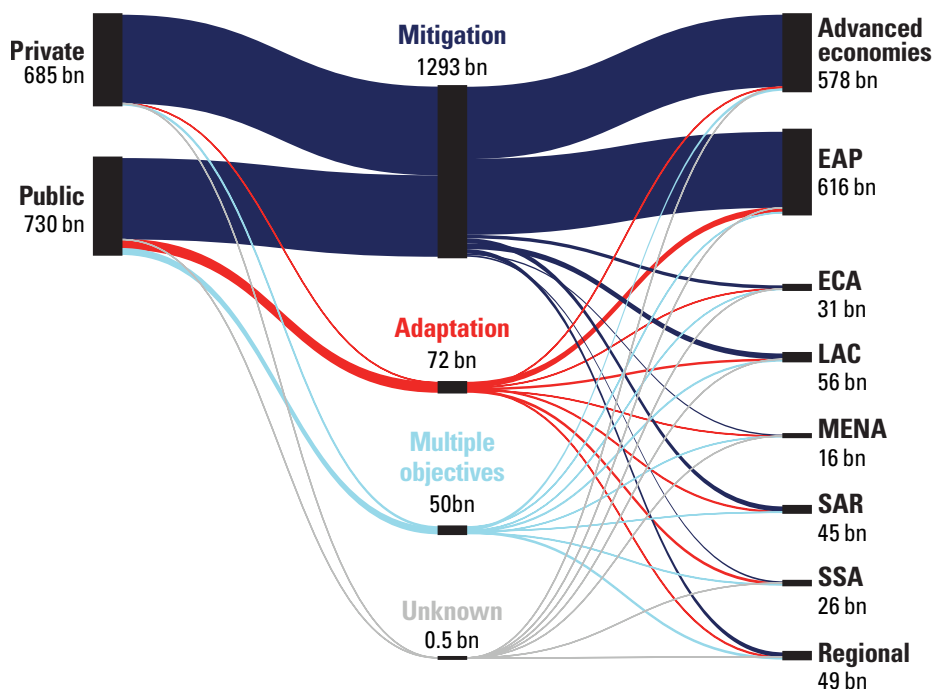
individual shocks, meaning that shocks are amplified nonlinearly. An illustrative analysis found that the impact of compound shocks (such as a flood or typhoon combined with a pandemic) can be up to 35 percent greater than the sum of the impacts of the natural disaster and pandemic (Ranger, Mahul, and Monasterolo 2022). In the Philippines, a stress test found that the occurrence of a large typhoon during a COVID-19-like pandemic increased the impact of the typhoon on bank capital by nearly 9 percentage points compared to a scenario without a pandemic (Hallegatte et al. 2022). Omitting the amplification factor of compound shocks can result in an underestimation of overall risk. As such, there is increasing recognition of the importance of accounting for compounding risks in climate risk analysis for the economy and financial sector (NGFS 2023c).

In addition to elevated climate risks, EMDEs face a substantial financing gap to fund low-carbon and climate-resilient economic growth—with more limited domestic and private sector financing for climate goals. Most climate finance is channeled toward China and advanced economies, predominantly for mitigation purposes (figure 3.2, panel a). Unlike many EMDEs, these markets rely mostly on substantial domestic finance to fund low-carbon investments. World Bank analysis, using data from Buchner et al. (2023), shows that in AEs, 90 percent of reported climate finance is from domestic sources, mainly from private sources (66 percent). In China, domestic finance makes up 99 percent of total climate finance, with almost two-thirds stemming from public sources. Meanwhile, in other EMDEs the share of domestic finance is much lower (46 percent), with the majority (54 percent of all climate investment) coming from public sources. Overall, China remains the largest provider of climate finance globally, accounting for over 40 percent of all reported global climate finance flows (figure 3.2, panel b).⁶⁹ Meanwhile, only 14 percent of reported total domestic and international climate finance flows reaches EMDEs other than China, even though they represent around 25 percent of global GDP. EMDEs (excluding China) require far greater investment than they currently receive to meet the climate adaptation and mitigation targets set by the Paris Agreement.⁷⁰ World Bank Country Climate and Development Reports (CCDRs) estimate that a total of \$574 billion (2.8 percent of GDP) in additional annual climate-related investments are required in all LICs and MICs other than China between now and 2030, which is nearly three times today's climate finance flows to EMDEs (figure 3.2, panel c).^{71, 72, 73} This includes a large financing need for adaptation and resilience investment.⁷⁴ Currently, adaptation financing accounts for just 16 percent of climate finance flows to EMDEs (excluding China), with 98 percent of it provided by public actors (Buchner et al. 2023).⁷⁵ But channeling more finance for adaptation and resilience investment in EMDEs is challenging, as it requires high upfront costs to reap benefits in the long term.

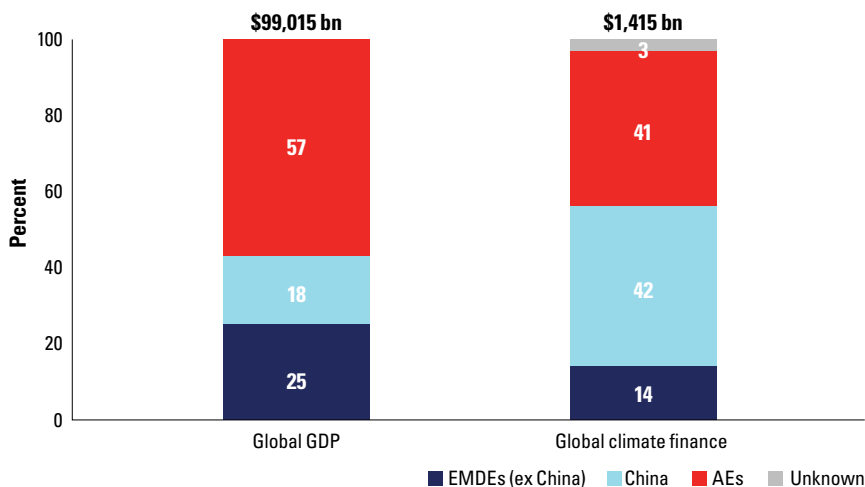
Bridging the financing gap will also require scaling of cross-border climate finance sources, particularly from the private sector. Cross-border climate finance inflows to EMDEs are dwarfed by total cross-border capital inflows (figure 3.3, panel a). Although EMDEs receive over 60 percent of global climate finance inflows, which compares favorably to their share of global capital inflows, around 86 percent comes from public sources (figure 3.3, panel b) such as multilateral and bilateral agencies. Given the constraints public sources face, there is a need to mobilize private sector sources.

FIGURE 3.2 EMDEs Face a Significant Gap in Climate Finance as Most Climate Finance Is Directed Toward China and Advanced Economies, with Private Finance Predominantly Allocated to Projects Focused on Mitigation Efforts

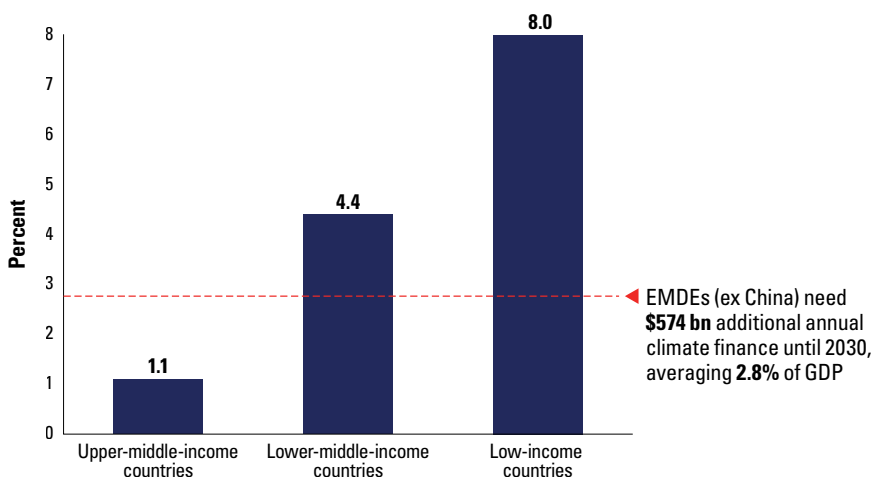
a. Global climate finance flows by source type, use case, and region of destination in 2022 (\$, billions)



b. Composition of global gross domestic product (GDP) versus global climate finance in 2022



c. Additional annual climate finance needs between 2023 and 2030 by income level (percent of gross domestic product)

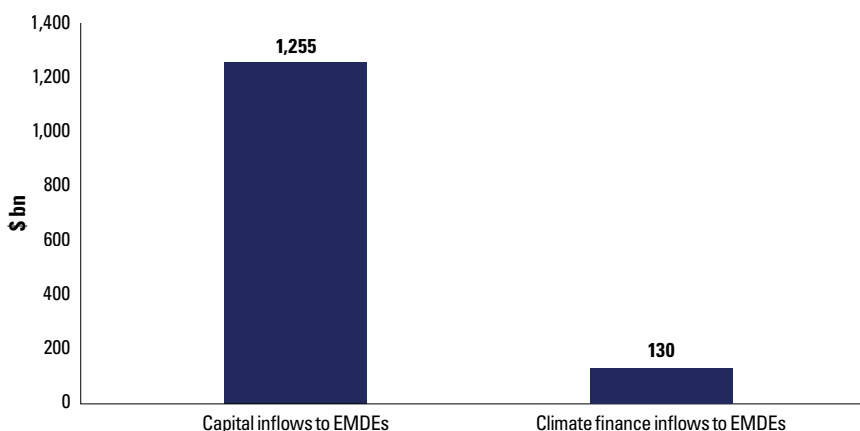


Source: World Bank staff calculation based on Buchner et al. (2023) and World Bank (2023d)

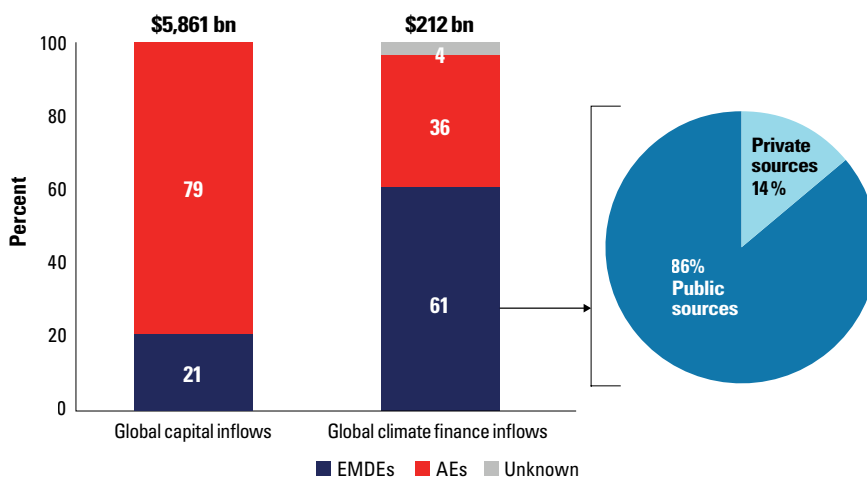
Note: Panel a: Because of rounding, the numbers presented may not fully match across the different flows. "Multiple objectives" covers financing for projects that provide both mitigation and adaptation benefits. "Unknown" implies uses that cannot fully be traced. "Regional" refers to climate flows that are not confined to a single region but instead span across multiple regions. bn = billion; EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia region; SSA = Sub-Saharan Africa. Panel b: "Global GDP" is based on GDP at current prices. "Global climate finance" covers both domestic and cross-border flows in 2022. These estimates are subject to limitations. Buchner et al. (2023) highlight the likelihood of incomplete climate finance data, noting gaps in domestic flows. Panel c: Additional annual climate finance needs in EMDEs between now and 2030 are based on estimates by World Bank Country Climate and Development Reports (CCDRs). Additional investment needs are defined as the difference between a resilient and low-carbon development scenario and a business-as-usual development scenario. The investment needs per income category are based on 42 CCDRs. The total additional annual investment needs cover all EMDEs ex China and are based on an extrapolation of CCDR findings.

FIGURE 3.3 Cross-Border Climate Finance Inflows to EMDEs Are Small Compared to Total Capital Inflows, and While EMDEs Receive Most of the Cross-border Climate Inflows, a Relatively Small Share Comes from Private Sources

a. Total cross-border capital flows and cross-border climate finance inflows to EMDEs in 2022 (\$, billions)



b. Composition of global cross-border capital inflows and global cross-border climate inflows in 2022 (percent)



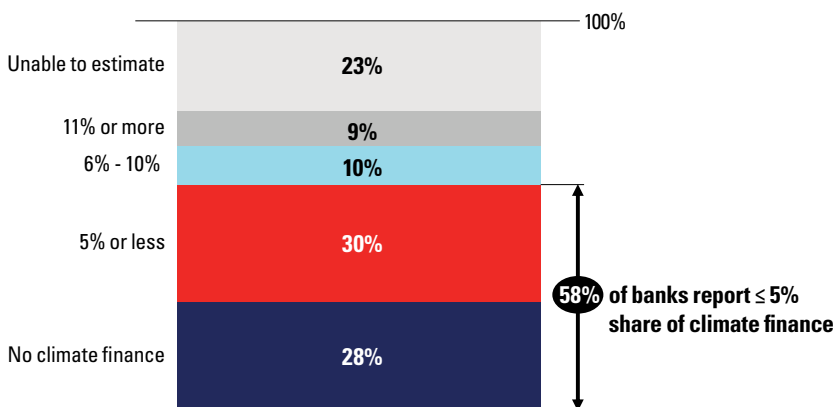
Source: World Bank staff calculation based on International Monetary Fund Balance of Payments, Buchner et al. (2023)

Note: Panel b: “Global capital inflows” are gross cross-border capital inflows comprising foreign direct investment, portfolio investment, and other investment. “Global climate finance inflows” are international climate finance flows. The share of public and private sector climate finance inflows to EMDEs is estimated based on inflows from AEs to EMDEs, EMDEs to other EMDEs, and unidentified regional sources to EMDEs.

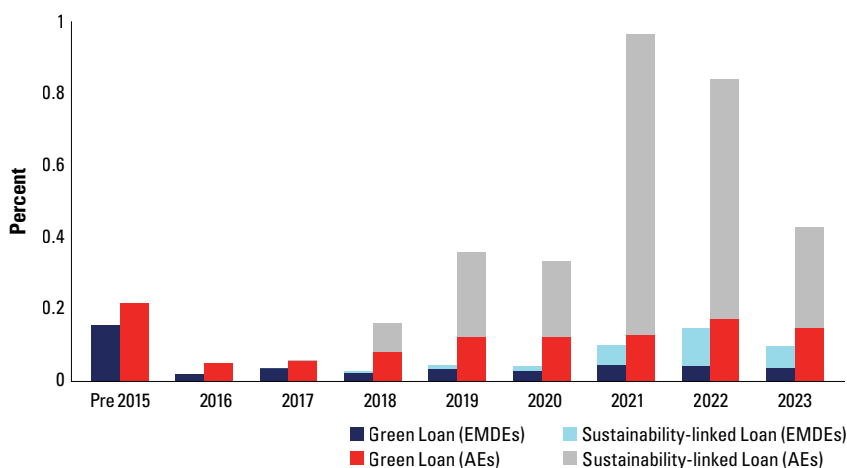
A broad range of policy support is required to mobilize more of this needed climate finance, including increasing the amount of climate-related lending by EMDE banks from current low levels. The banking sector in EMDEs provides less credit to GDP overall than in advanced economies, and also supplies only limited amounts of climate finance. According to a World Bank survey, climate financing is 5 percent or less of the lending portfolio for nearly 60 percent of EMDE banks—with 28 percent providing no climate financing at all and 23 percent unable to estimate (which highlights the noted data challenges). While respondents indicated plans to increase that share in the future, this remains well below the amount of climate lending by banks in advanced economies (figure 3.4). This disparity is an issue, as banks dominate the financial sector landscape in EMDEs, accounting for over 80 percent of financial sector assets (compared to 50 percent in advanced economies), according to the World Bank FinStats Database. As De Haas (2023) and others have argued, adequate, broad policy support and the right incentives could create more profitable climate-related investment opportunities and allow a larger share of banks’ balance sheets to be mobilized for climate finance. Such support is particularly needed in countries where fiscal space is constrained, and public sources of financing are scarce.

FIGURE 3.4 Climate Finance by EMDE Banks Is Limited, with Relatively Lower Levels of Green Loan Issuance Than in Advanced Economies

a. Share of climate finance in surveyed EMDE banks⁷⁶ lending portfolios (percent of total loans)



b. Breakdown of green loan and sustainability-linked loan issuance by EMDEs/AEs (percent of gross domestic product (GDP))



Sources: Panel a: World Bank staff calculation based on IFC data. Panel b: World Bank staff calculation based on Buchner et al. (2023) and Bloomberg New Energy Finance Database 2024.

Note: Panel a: Analysis based on data collected from 177 International Finance Corporation financial institution clients, surveyed in 2021. Considering the time lag and that many surveyed institutions indicated plans to undertake relevant actions in the medium term, the picture provided may have evolved over time. AE = advanced economies; EMDEs = emerging market and developing economies; GDP = gross domestic product. Panel b: Country classification following World Bank Global Economic Prospects. Sustainability loans includes both green loans and sustainability-linked loans. Supranational loan issuance is not included in the calculation. Current GDP is summarized from all EMDEs and advanced economies for each year. Growth projections by the International Monetary Fund are used for 2023 GDP.

Addressing climate risks and mobilizing climate finance is especially challenging in EMDEs because of context-specific challenges and market failures. Challenges related to climate finance are often symptomatic of broader issues with mobilizing development finance in EMDEs. These include a mismatch between investors’ risk-return appetites and the risk profile of investment offerings; market failures; demand-side weaknesses including a lack of bankable projects; institutional capacity; policy shortcomings; foreign exchange risk; and inadequate risk-sharing mechanisms. Challenges with a lack of funding (low revenue or no cash flow) arise with development projects, particularly in the climate adaptation space.

Further challenges to mobilize climate finance stem from data limitations, capacity constraints, and gaps in the enabling policy environment, among other factors. A lack of classification systems for green activities inhibits financial markets and banks from accurately and comprehensively pricing certain externalities caused by climate risks and identifying financing opportunities (Schnabel 2020). This is particularly pertinent in EMDEs, where gaps in disclosure, reporting, and taxonomies (which define green activities) persist. Only 10 percent of EMDEs have sustainable finance taxonomies in place, versus 76 percent of advanced economies.⁷⁷ Less than 20 percent of these taxonomies in EMDEs

are mandatory and integrated in national financial regulation (as opposed to 95 percent of taxonomies being mandatory in advanced economies), which arguably makes them less effective (see box 3.2). Weak regulatory frameworks and limited technical capacity to implement global standards, including climate disclosure and reporting, also hinder the assessment of climate-related financial risks in EMDEs.⁷⁸ In addition, EMDE capital markets are often shallow and underdeveloped, and insurance penetration is generally low, resulting in limited financial product offerings that address climate issues as well as a lack of innovation.

Box 3.2 Green or Sustainable Finance Taxonomies

A green or sustainable finance taxonomy is a classification system for identifying activities or investments that will move a country toward specific targets related to priority environmental objectives (ICMA 2021). Adopting climate tools and assessing their impacts require clear, green taxonomies, sufficient data, and broader information systems to help stakeholders understand what is “green” and what is not. These taxonomies have the potential to become not only a powerful tool for policy makers and regulators, but also a source of clarity and confidence for corporate and financial sector actors.

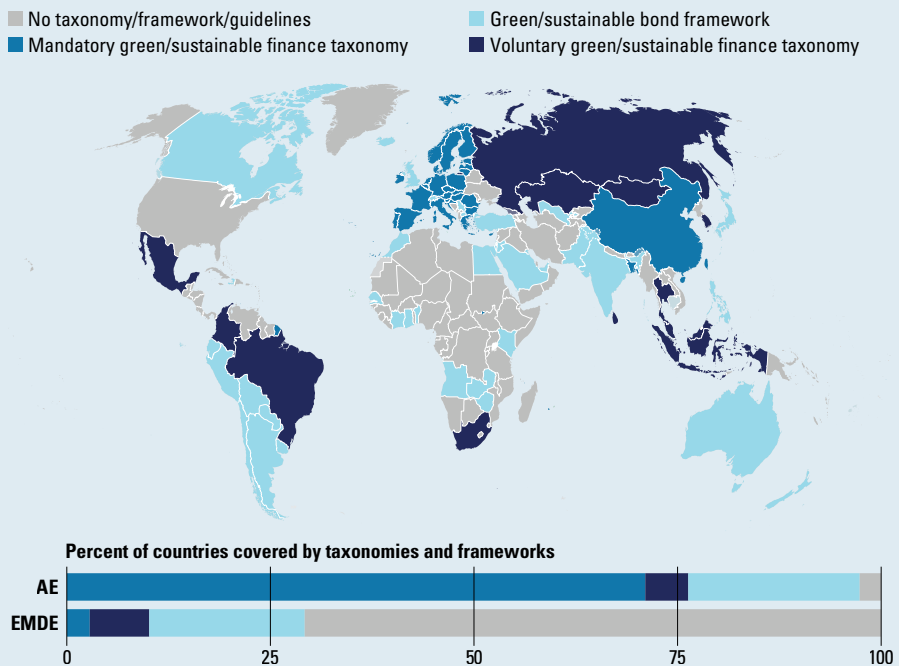
In addition to national or regional green or sustainable taxonomies, other frameworks can be used to identify economic activities eligible for sustainable financing, such as green bond guidelines. Taking this broader set of frameworks into account, around one-third of emerging markets and developing economies (EMDEs) and over 97 percent of advanced economies are covered by some form of classification scheme (figure B3.2.1), and the pace of coverage has accelerated in the past two years. While not always in the driver’s seat, banking authorities in EMDEs are increasingly cooperating with other stakeholders, including finance and environmental ministries and securities supervisors, to establish taxonomies.

Currently there is no universally agreed-upon approach to developing a taxonomy. In some cases (such as in the European Union), the taxonomy is very detailed, with screening criteria such as activity metrics and thresholds to define the eligibility of activities. In other cases (such as in the Association of Southeast Asian Nations), the taxonomy describes high-level principles that guide green investments. Furthermore, while most taxonomies are voluntary instruments that financial institutions and corporations can use to identify sustainable activities, in several countries they have become part of financial regulation and their use is now mandatory, especially for reporting and disclosure obligations (including in Bangladesh, China, Colombia, and Mexico).

With the increase of initiatives to develop national and regional taxonomies, the risk of

proliferation of differing definitions, a fragmentation of approaches, and a consequent increase in transaction costs, especially for cross-border investments, can be significant. Work is being done to support interoperability between approaches by ensuring that differing initiatives apply a common architecture and structure (including “do no significant harm” standards), while allowing for national and regional circumstances to inform the specific calibration of parameters to identify positive and negative contributions to sustainability goals. While taxonomies serve as a valuable tool to guide sustainable finance, it is important to recognize that they are not a panacea. There are limitations to their applicability and effectiveness in addressing the complex challenges of sustainable finance, and they should be seen as part of a broader set of strategies to accomplish climate goals.^a

FIGURE B3.2.1 Increasing Number of Countries Covered by Taxonomies or Sustainable Bond Frameworks While a Majority of EMDEs Still Lack a Mandatory Reference Classification for Sustainable Activities



Source: World Bank staff calculations.

Note: AE = advanced economies; EMDE = emerging market and developing economies.

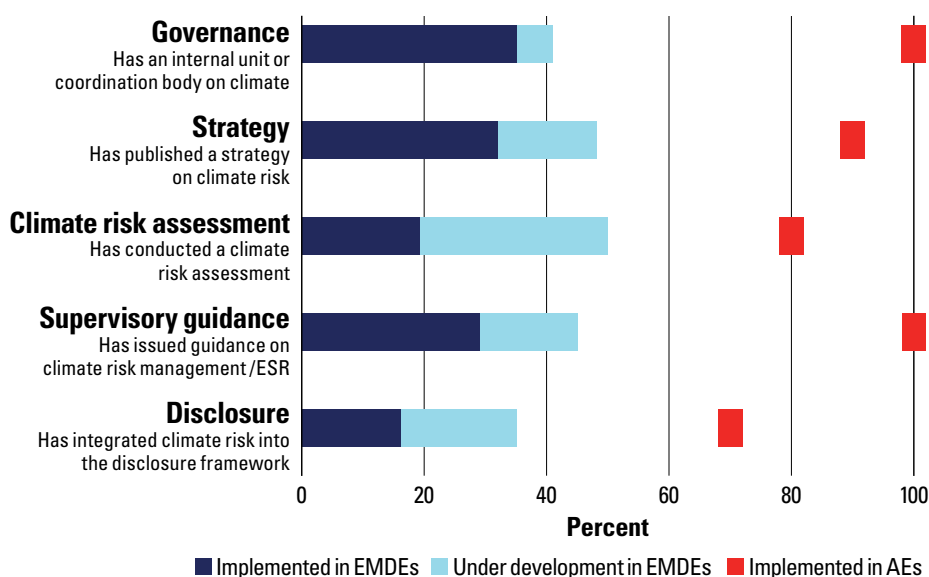
a. See G20 Sustainable Finance Working Group, G20 Sustainable Finance Roadmap (G20 Sustainable Finance Working Group 2021), which includes six principles for the development and global coordination of approaches to align investments with sustainability goals. The International Platform for Sustainable Finance has been working on alignment between the EU’s and China’s taxonomies.

How EMDE banking authorities are addressing climate-related financial risks

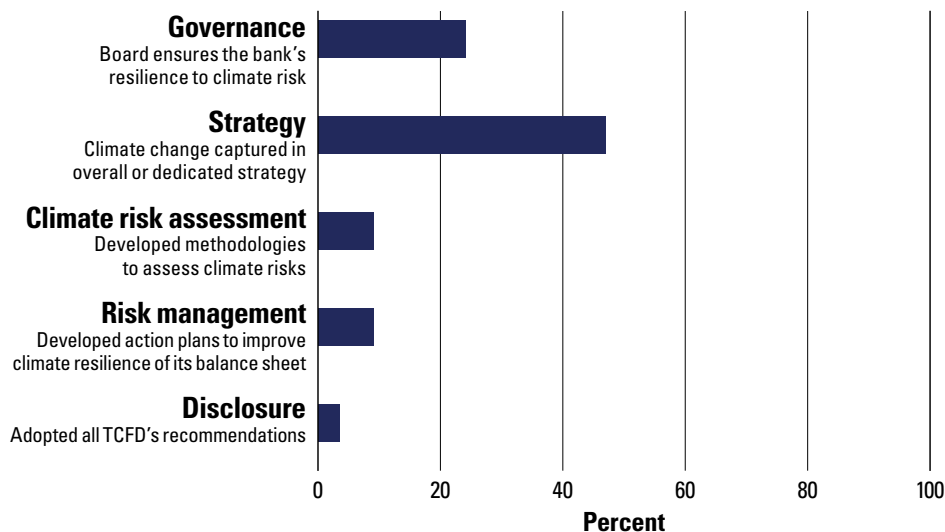
Financial sector standard setters and authorities globally have made significant advancements in incorporating climate—and increasingly nature and biodiversity—risks into their standards, regulations, and supervision.⁷⁹ But progress in EMDEs remains mixed. This effort has been guided by various global initiatives, including the Basel Committee on Banking Supervision (BCBS), the Financial Stability Board (FSB), and the Central Banks and Supervisors Network for Greening the Financial System (NGFS).⁸⁰ To date, efforts have been primarily focused on risks and opportunities related to climate mitigation rather than adaptation, although the latter may often be more relevant for EMDEs. EMDE banking authorities are at various stages of building their overall prudential regulation and supervisory functions. Progress has mostly been in middle-income countries (figure 3.5, panel a). Similarly, the management of climate risks within EMDE banks is still in its early stages (figure 3.5, panel b).⁸¹

FIGURE 3.5 EMDE Banking Authorities Are in the Earlier Stages of Climate Risk Supervision, While Climate Risk Management by EMDE Banks Is in Its Infancy

a. Share of banking authorities implementing selected supervisory actions related to climate risk (percent)



b. Share of EMDE banks⁸² that have adopted selected actions related to climate risk (percent)

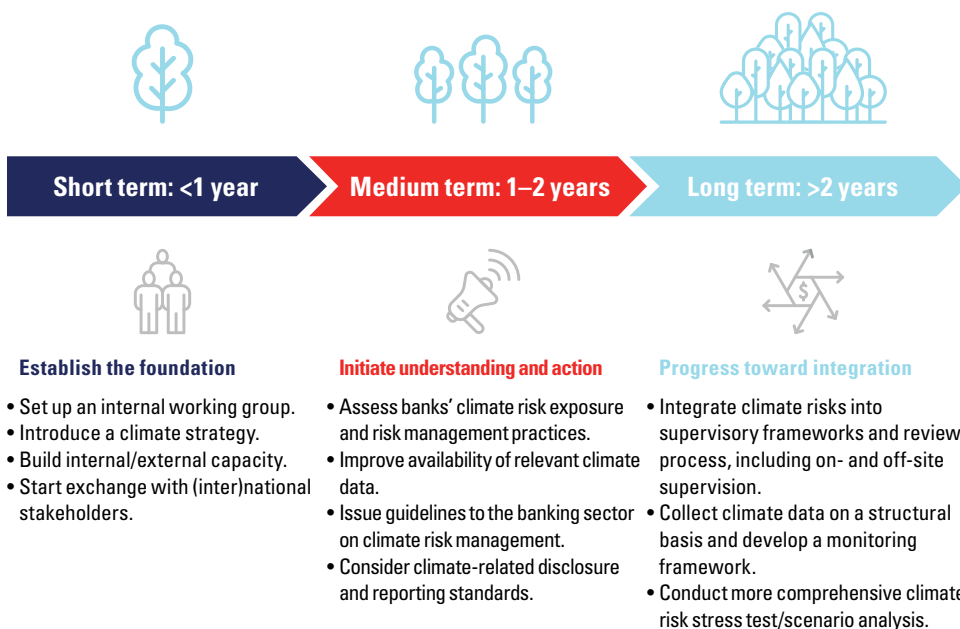


Sources: Panel a: World Bank staff calculations. Panel b: World Bank staff calculations based on IFC data.

Note: Panel a: EMDE sample based on World Bank climate diagnostics and technical assistance in 31 countries. (Since 2019, the World Bank has conducted climate diagnostics in 24 jurisdictions and provided technical assistance to several other countries. Diagnostics include detailed analyses of local financial sectors' exposure to climate and environmental risks, responses from financial institutions and authorities, climate finance needs, barriers, and opportunities.) Advanced economies sample based on publicly available information on the 10 AEs with the highest GDP. Panel b: Analysis based on data collected from 177 of IFC's financial institution clients, surveyed in 2021. Considering the time lag and that many surveyed institutions indicated plans to undertake relevant actions in the medium term, the picture provided may have evolved over time. AEs = advanced economies; EMDE = emerging market and developing economies; ESR = environmental and social risk; GDP = gross domestic product; IFC = International Finance Corporation; TCFD = Task Force on Climate-related Financial Disclosures.

Lessons are surfacing on how to apply risk management tools in a sequenced manner in EMDEs, taking account of authorities' needs to strengthen their overall supervisory and regulatory frameworks. Given the need for many EMDE banking authorities to build general regulatory and supervisory capacity, their approaches to addressing climate risks need to be adapted to their local context.⁸³ Successful examples show the need for banking authorities to consider a multiyear, phased approach to adopting climate risk tools. For example, banking authorities in Colombia and Jordan first established dedicated working groups that devised strategies to integrate climate risks into supervisory frameworks. In the Arab Republic of Egypt, India, and Nigeria, the central bank's first steps included an extensive capacity building program to impart understanding of climate risks among supervisors. Authorities can then move on to assessing risk management practices, issuing guidance, and incorporating these strategies into their supervisory frameworks (figure 3.6).

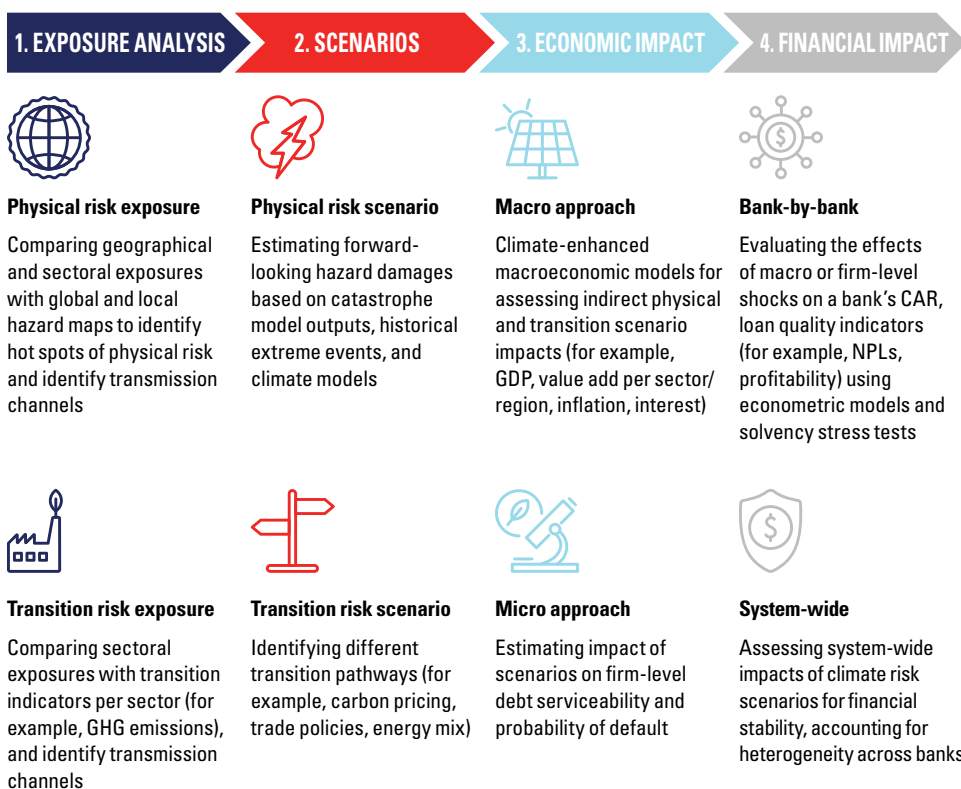
FIGURE 3.6 Illustrative Processes for Sequencing the Adoption of Climate Risk Tools



Source: World Bank staff.

The need for climate risk analysis tools to be adapted to local contexts is driving innovation by EMDE authorities. Climate-risk analysis estimates the impacts of physical and transition risks to the financial system using a range of methodological approaches, from basic exposure assessments to complex stress tests (figure 3.7). While the NGFS provides supervisors with comprehensive scenario and data support, addressing challenges in EMDEs requires innovative and tailored approaches. Given the heightened vulnerability to physical risks from climate change, EMDE stress tests often incorporate pioneering elements, which can help drive improvements in credit risk analysis globally. For example, in Colombia, where specific catastrophe and macroeconomic models to inform scenarios are lacking, historical correlations between climate events and nonperforming loans were used to estimate physical risk impacts on banks (Reinders et al. 2021). Other leading innovations include Morocco's Banque Al Maghrib's first-of-its-kind drought scenario, the typhoon scenario devised by the central bank in the Philippines, and a "season of climate risks" scenario created for Mexico.

FIGURE 3.7 Overview of a Comprehensive Climate Risk Analysis



Source: World Bank staff.

Note: CAR = capital adequacy ratio; GHG = greenhouse gas; NPLs = nonperforming loans.

Designing proportionate regulations that address climate-related financial risks without imposing too onerous a regulatory burden on banks is a particular challenge for EMDE banking authorities. Proportional supervisory requirements align oversight with the nature, scale, and complexity of a bank's business models. Proportionality is particularly important in EMDEs where banking sectors may need support to develop overall. At the same time, banking authorities need to recognize the climate risks that banks face. The National Bank of Rwanda has adopted a proportional approach in its climate risk guidelines. Its approach involves adapting requirements based on the materiality of climate risks for the institution. Such approaches will still need to recognize the potential risks for niche sectors such as local agriculture banks.⁸⁴

Unintended consequences of climate risk management requirements—the potential impacts on financial inclusion, in particular—need to be carefully considered and anticipated. Regulatory responses to address climate risk could exacerbate financial











exclusion if not carefully designed.⁸⁵ For example, transaction costs associated with climate-related due diligence could price out vulnerable and low-income clients such as rural households and small enterprises.⁸⁶ These clients' curtailed access to finance could render them less able to invest in climate adaptation and resilience, increasing the vulnerability of the real economy, with potential feedback effects for financial stability. Instead, inclusive policy and regulatory action can create a virtuous cycle whereby expanded access to financial services improves resilience, reduces climate impact on the economy, and enhances financial stability.




Poorly designed and/or implemented regulatory tools could result in banking authorities not achieving their intended goals (such as merely shifting carbon-intensive activities instead of reducing them). One World Bank study found that requiring the incorporation of environmental considerations into the capital adequacy assessment for larger banks in Brazil may have resulted in shifting lending to high-carbon sectors to unregulated, smaller banks, leaving emissions of the economy overall largely unchanged (Miguel, Pedraza, and Ruiz-Ortega 2022).⁸⁷ Such consequences need to be considered and, if possible, avoided.

How EMDE Banking Authorities Are Enabling Climate Finance

Central banks and prudential authorities are starting to implement approaches that support mobilizing climate finance. However, guidance for applying them is lacking and their potential effectiveness is both mixed and unproven. There is already a broad consensus⁸⁸ that supporting an orderly transition to a low-carbon economy will minimize future risks to financial stability, making such a transition relevant to the mandates of central banks and prudential supervisors. Banking authorities globally are currently testing new approaches to support the mobilization of climate finance—some of them encouraged by their governments—that seek alternative ways to promote climate finance given their constrained fiscal space. The number of approaches to these efforts is vast and ranges from prudential and monetary policy tools to direct credit guidance (figure 3.8). Most tools are relatively new, and empirical evidence on their suitability and effectiveness (as well as potential negative impacts on the core objectives of stability and inclusion) is still emerging, both in advanced economies and EMDEs. As yet there is also limited to no guidance from international standard setters on the use of these tools. Deployment depends on numerous factors, including evidence of the tools' effectiveness and potential market distortions, country context, and addressing concerns around “greenwashing.” Experience to date indicates that the effectiveness of tools can broadly be divided into three categories: win-win, the jury's still out, and not recommended.

FIGURE 3.8 Emerging Applications of Tools to Manage Risk and Enable Climate Finance

Area	Tool	Example	Category
Microprudential tools	Transition plans	Philippines, Singapore (announced), EU, Ghana	
	Adjusted risk weights (green supporting factor/penalizing factor)	Hungary, Indonesia	
	Post-disaster regulatory response	Bangladesh, Philippines, India	
Macroprudential tools	Adjusted loan-to-value ratio	Indonesia, Netherlands	
	Concentration threshold	Philippines, Explored by EU	
	Sectoral systemic risk buffer	Explored by EU	
Credit allocation policies	Direct credit guidance/lending quota	Bangladesh, Fiji, India	
Central bank tools	Credit facilities/targeted refinancing operations	Bangladesh, China, Egypt, Japan, Malaysia	
	Collateral management	China, EU	
	Reserve requirements	Indonesia, Lebanon, Philippines	

 Win-win  Jury's still out  Not recommended

Source: World Bank staff.

Note: Effective and appropriate deployment of “win-win” tools needs to be risk based and well designed; it also depends on prerequisites such as evidence on their application and reliable data. EU = European Union.

“Win-Win”: Tools That Support Both Financial Stability and Climate Finance Objectives, If Adequately Designed

Transition planning is a promising measure within the microprudential toolbox, which is focused on individual institutions’ risks, but in EMDEs such planning will require a strong focus on adaptation. Transition plans entail the alignment of a financial institution’s strategy and portfolio with relevant climate objectives and regulations in their jurisdictions, using a set of targets, metrics, and actions. As a prudential tool, transition plans can help banking authorities and investors better understand how a financial institution plans to align its operations with climate regulations and take advantage of green opportunities. Yet because most EMDEs have low greenhouse gas emissions and high vulnerability to physical risks, a stronger focus on adaptation rather than mitigation is warranted by institutions, banking authorities, and standard setters developing these plans in EMDEs.

Interventions using macroprudential tools, which address systemic features of climate change, are increasingly being explored, with some promising results. These measures

may decrease systemic risk while supporting the enabling environment for aligning financial flows with climate goals. Macroprudential tools under consideration include sectoral systemic risk buffers (SyRB) and concentration thresholds, though these tools are not yet widely used.⁸⁹ Borrower-based measures such as adjusted loan-to-value (LTV) ratios seem promising, as they offer relatively high operational feasibility (if appropriately risk-based), and several implementation examples exist. Adjusted LTVs for green mortgages (as implemented in Indonesia and the Netherlands⁹⁰) can address climate risk at the loan level and promote investments in energy efficiency measures.⁹¹

Adequate post-disaster regulatory responses can support borrowers and ensure the flow of credit to the economy while still safeguarding bank resilience. Authorities are using temporary regulatory relief measures during and in the aftermath of climate-related shocks to provide liquidity and facilitate bank lending. Such measures have been applied in Peru (where the prudential supervisor adopted measures requesting financial institutions to reschedule retail loan repayments in the event of specific natural disasters), and in the Philippines (where the central bank outlined a set of temporary regulatory relief measures to banks affected by calamities). Lessons on how to apply such measures successfully could be drawn from similar responses to support the flow of credit during the COVID-19 crisis (see Dikau and Volz 2020; World Bank 2020).

“The Jury Is Still Out”: Tools That Have the Potential to Enable Climate Finance but Require Further Analysis Until There Is Enough Evidence to Establish Their Suitability

Some central banks have started to adapt their operational and monetary policy frameworks to include climate considerations, but this practice is not yet widespread, particularly in EMDEs.⁹² Interventions mostly involve modifications of existing tools, such as central bank credit operations, collateral frameworks, asset purchasing programs (such as quantitative easing, or QE), or differential reserve requirements.⁹³ Credit facilities or collateral management could account for climate factors by making pricing, eligibility, or haircuts dependent on a counterparty’s or an asset’s environmental credentials. For example, the People’s Bank of China (PBoC) has amended its collateral framework to include green bonds and securities in its medium-term lending facility.

There is growing attention for targeted refinancing operations (TROs), which support banks’ green lending practices by providing central bank loans at favorable conditions—but more evidence is needed. Part of central banks’ credit operations, TROs generally provide refinancing at longer maturities, lower interest rates, or both. These operations have been used by central banks to support small enterprises and select economic sectors and they are increasingly being explored for green purposes.⁹⁴ For example, the Central Bank of

Egypt currently operates various green credit facilities that provide financing to commercial banks at zero interest to on-lend at below-market rates, including to farmers and renewable energy projects. Likewise, the PBoC launched a carbon emission reduction facility, which provides lower-cost funding for banks that on-lend to selected green sectors. Although TROs may be effective and appropriate as transitory tools to support market creation, they could have distortionary impacts in the longer term, including financial stability implications.

Central banks can also ease or tighten reserve requirements to incentivize bank lending to low carbon activities, but ensuring that these interventions do not interfere with monetary policy is a work in progress. Some central banks (such as in Indonesia) exempt commercial banks from a share of reserve requirements for providing a certain number of green loans. This policy changes their relative cost of capital and thus enables financing of green projects at a lower cost. As a transitory measure, the Philippines central bank has also reduced its reserve requirement rate to incentivize banks to finance green projects.⁹⁵ However, while these interventions could have a strong signaling effect, they could also interfere with broader monetary policy interventions.

“Not Recommended”: Tools That May Enable Climate Finance but Have a Higher Likelihood of Compromising Financial Stability or Market-Neutrality Objectives

Adjusting assets’ capital risk weights could create an incentive to adjust financing to green or high-carbon sectors—but there is little evidence of the efficacy of such interventions, and they could introduce unintended consequences. Preferential capital treatment entails a downward adjustment to the risk weighting for green assets (also known as a “green supporting factor”). Equally, authorities can increase risk weights for lending to high-carbon sectors, thereby addressing and penalizing firms’ exposure to high-carbon industries and avoiding under-capitalization in case climate risks materialize. To date, there is limited evidence that green and non-green assets carry different levels of risk.⁹⁶ Furthermore, there is no evidence as yet that such measures directly impact pricing or lead to increased credit to targeted sectors (partially because they will not work alone, and they also need adequate supporting fiscal and other government policies to be in place).⁹⁷ Consequently, caution is needed in making such changes to capital regimes as they may introduce risks and distortions; as such, adjustments through the supervisor’s own review process currently are more appropriate. Over time, as approaches mature, adjustments to capital requirements could also be informed by climate-risk stress-testing exercises.⁹⁸

Some EMDE authorities require banks to mobilize a certain amount of climate finance; however, this practice has a mixed history and potentially distortionary effects. Credit allocation policies seek to steer financial flows to green sectors or projects. Some supervisory authorities, including the Bangladesh Bank⁹⁹ and the Reserve Bank of India, set quantitative

targets such as the share of a bank’s portfolio to be allocated to green sectors. Such measures have been used for non-green purposes by EMDE financial supervisors for decades—with mixed results. For example, directed lending programs were used extensively in the second half of the twentieth century for priority sectors such as agriculture and small enterprises, including in India, Pakistan, and Brazil. While the literature is not conclusive, such policies are often associated with distorting the efficient allocation of capital, lower levels of productive investment, negative impacts on financial system stability, and with undermining domestic and global competition in the banking sector. Similarly, these programs often led to an accumulation of bad debts and an increase in NPLs.¹⁰⁰ If meeting lending targets is prioritized over prudent risk management, direct credit guidance may also create moral hazards and adverse selection risks. Green credit targeting also requires a clear definition to avoid “greenwashing.”¹⁰¹

The Need for Broader Policy Support beyond Banking to Mobilize Climate Finance

Closing the climate financing gap requires broader policy support and leveraging financing sources beyond the banking sector. Fiscal policies including carbon pricing measures, the managed phase-out of fossil fuel subsidies, and the strategic deployment of renewable energy-related subsidies are critical interventions to align financial and policy incentives with climate goals, (see box 3.3 for a broader discussion on incentives and green technology adoption by firms). Fiscal interventions generally provide the most targeted and effective tools to facilitate the scale-up of climate finance (Pigato 2019). Robust fiscal transfers will also be needed to protect vulnerable households, workers, and communities, and ensure a just, green transition (Calice and Demekas 2024). Similarly, the right policies need to be in place to promote the demand side. The foundational data and definitions (taxonomies and so on) required for the banking sector to mobilize climate finance are also needed to support these other sources.

Box 3.3 Firms and the Demand for Climate Finance: Driving Adoption of Green Technology

The supply of climate finance is not the only, or in some cases the primary, constraint to greening firms’ production processes. A comprehensive literature review in the World Bank’s South Asia Development Update (World Bank 2023b) highlights that firms need more than just financial resources to adopt green technologies. Interventions like information dissemination, market regulations, and pricing policies play crucial roles in stimulating

industrial firms' demand for green finance and promoting environmentally friendly investments (figure B3.3.1). The study found that market-based regulations such as carbon pricing are particularly effective in encouraging green technology adoption. Instead, administrative regulations like quotas are less effective and often produce unanticipated side effects. Information campaigns and behavioral nudges have fewer unintended consequences, but their effectiveness is more uncertain. Rigorous evidence that financing policies can promote technology adoption is promising but has only recently begun to emerge.

Information dissemination. Firms often lack awareness of green technologies, with surveys indicating information scarcity as a constraint. However, policies providing information on efficient technology have had mixed results. Integrating information with better business practices, like monitoring and management involvement, can enhance technology uptake. Behavioral nudges, such as reminders and peer comparisons, have been cost-effective policies in reducing energy consumption among households and may be able to play a similar role for small and informal firms.

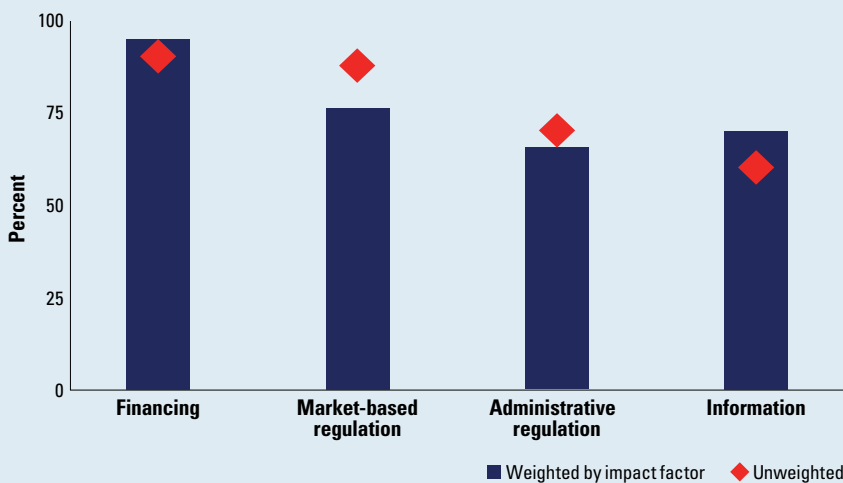
Command-and-Control Environmental Regulation. Regulations that make firms internalize externalities can boost green technology adoption and finance demand. Emission quotas, a form of command-and-control regulation, have effectively reduced pollution in India, China, and the US. However, they can lead to unintended outcomes, like firms moving to less regulated areas. Their success relies on strong enforcement, which corruption and low state capacity can undermine.

Market-based regulations. Emissions pricing regulations, such as the European Union Emissions Trading System and California's cap-and-trade program, have shown benefits similar to command-and-control regulations but with fewer distortions. These schemes have increased the adoption of energy-efficient technologies and reduced emissions while avoiding the adverse side effects of quota systems. However, the effectiveness of these regulations can be limited by uneven application and low carbon prices.

Pricing policies. Without proper price signals, green technology adoption may not be sufficiently profitable for firms. Carbon taxes and the elimination of fossil fuel subsidies can help close the gap between the social and private costs of emissions, encouraging investment in low-carbon technologies. Empirical evidence supports the effectiveness of pollution taxes in increasing clean technology R&D expenditures. However, once prices reflect the true social costs of carbon, firms must have access to finance for investment in cleaner technologies. The evidence on the effectiveness of carbon taxes on firm technology adoption remains limited and understudied.

Availability of finance. Financing constraints are also cited as a common barrier to firms’ adoption of green technology, energy efficiency, and emissions reduction. Studies have shown correlations between credit constraints and green technology adoption, energy intensity, and emissions. Temporary increases in firms’ cash flow can reduce emissions, while contractions in bank credit supply can hinder green technology adoption and increase emissions. However, evidence on the effectiveness of policies to ease firms’ credit constraints is still limited.

FIGURE B3.3.1 Studies Reporting Successful Policy Interventions to Stimulate Firm’s Green Technology Adoption or Energy Efficiency, by Type of Policy



Source: World Bank 2023b.

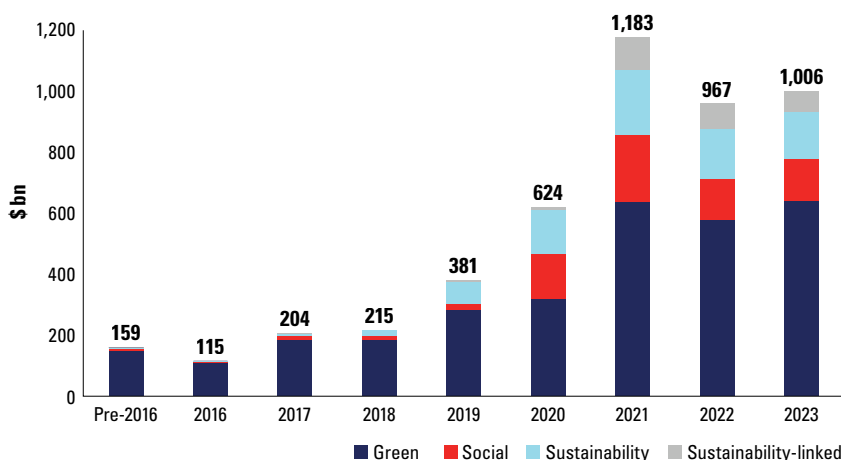
Note: Results are based on a review of 43 academic and policy studies on the impact of specific policy interventions (regulation, information/behavioral, and finance) on either firm green technology adoption or firms’ energy efficiency. Impact factor weighting uses the Research Papers in Economics (RePEc) ranking of the journal or working paper series in which the study was published. The sample consists of 10 studies on financing, 18 on regulation, and 15 on information. “Market-based regulation” covers emissions pricing regulations; “Administrative regulation” refers to command and control policies. Pricing policies have not been covered as part of the systematic review because of a limited amount of research on their impacts on firm technology adaptation.

Capital market development will be essential to closing the climate finance gap, but this is unlikely to offer solutions in the short run. Capital market development is a key prerequisite to mobilizing savings and private capital for climate mitigation and adaptation. Capital markets complement bank financing and can support financial intermediation, enhance transparency, and promote long-term finance, including for low-carbon infrastructure. Indeed, De Haas (2023) discusses how, relative to banks, stock markets may be better suited to fund innovative green technologies. Banks also secure a portion of their funding from capital markets, where they play a central role as the primary, private sector issuers of green and sustainability bonds in EMDEs.

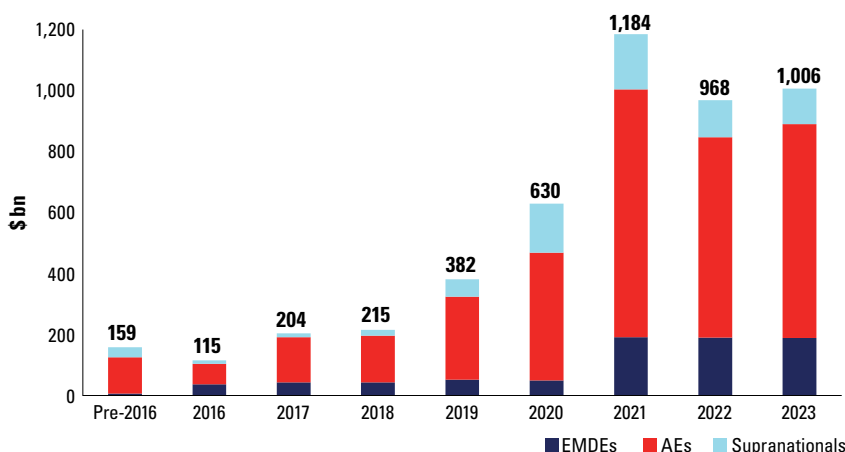
Innovative market-based financing instruments are starting to be deployed to leverage private climate financing beyond the banking sector. Sustainable debt securities now account for a cumulative \$4.8 trillion and represent around 5 percent of the global bond market, including green, social, and sustainable bonds (with proceeds earmarked for green projects), as well as sustainability-linked bonds (securities where the interest paid on the bond is linked to the achievement of predetermined environmental, social, or governance targets) (CBI 2022). Growth in sustainable debt markets has also picked up in some emerging markets, particularly since 2020 (figure 3.9, panel a), though these markets remain relatively small, primarily for lower-income and developing countries. EMDE annual issuance averages only 18 percent of global issuance over the last five years (figure 3.9, panel b). Beyond debt markets, 38 stock exchanges globally (of which two-thirds are in EMDEs) now include environmental, social, and governance (ESG) reporting as a listing requirement, corresponding to a market of approximately 20,000 companies and a domestic market capitalization of \$25 billion generating ESG metrics on a regular basis.¹⁰²

FIGURE 3.9 Growth Has Occurred in Sustainable Debt Issuance by Sovereigns and Corporates in EMDEs, but Emerging Markets Remain, on Average, Only about 18 Percent of the Global Total, Pre-2016–23

a. Total sovereign and corporate sustainable issuance by type of instrument (\$, billions)



b. Total sustainable issuance by AE/ EMDE (\$, billions)



Source: World Bank staff calculations based on data from Bloomberg New Energy Finance Database 2024.

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

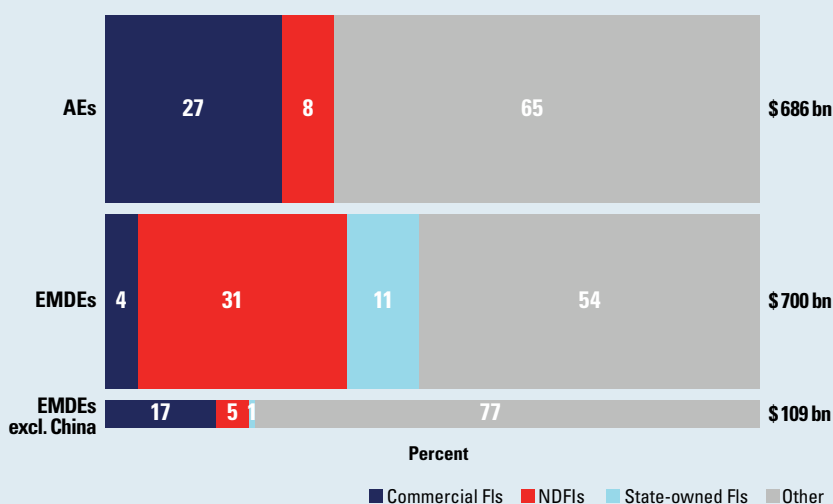
National development banks, public credit guarantee schemes (PCGS), and other national development financial institutions (NDFIs) can play a critical role in crowding in private sector finance and supporting the banking sector (box 3.4). In the short term, banking sectors in EMDEs will remain the primary financing source due to their dominance. Public institutions can support and complement commercial bank lending to help the sector play a larger role. For example, PCGS could support the development of the green credit market and the de-risking of lending to underserved sectors. In addition, PCGS can support funding to small and medium enterprises to transition to lower carbon business models and adapt to the impacts of climate change.¹⁰³ Multilateral development banks (MDBs) are also exploring innovative approaches to narrow the risk-return gap for attracting private capital by moving from a financing assets approach to financing risk capital, enabling counterparties to access capital markets and mobilize additional investors (Pesme, Verma, and Zhao 2023).

Box 3.4 Greening National Development Financial Institutions

National development financial institutions (NDFIs)^a are important actors for mobilizing financing from private sources to meet countries' climate financing needs. The combined assets of NDFIs exceed \$19 trillion and account for more than 10 percent of global investments annually. Globally, these institutions are a large source of climate finance, providing 19 percent of the

total (Buchner et al. 2023). NDFIs have both the scale and influence to play a transformative role, including in EMDEs. However, to date, reported climate finance attributed to NDFIs has been dominated by Chinese institutions. In EMDEs other than China, NDFIs still play a limited role in providing climate finance (figure B3.4.1). Over the last decades, some of these institutions have transformed into well-functioning and effective players in the development and climate finance space, while others still face challenges related to governance issues, low awareness, and limited technical expertise.

FIGURE B3.4.1 Percent of Climate Finance by Origin, 2022



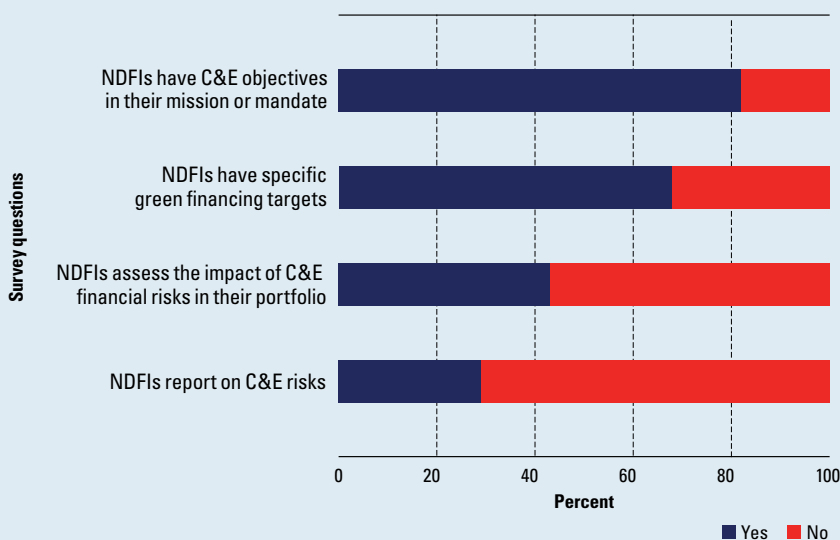
Source: World Bank staff calculations based on Buchner et al. 2023.

Note: AEs = advanced economies; bn = billion; EMDEs = emerging market and developing economies; FIs = financial institutions; NDFIs = national development financial institutions. These estimates are subject to limitations. Buchner et al. (2023) highlight the likelihood of incomplete climate finance data, noting gaps in domestic flows.

When adequately managed, NDFIs are well positioned to catalyze private sector financing and overcome market barriers associated with green investments, such as extended payback periods and perceived project risks. Compared to private investors, NDFIs have a greater appetite for financing long-term, high-risk investments. They have the tools to support private capital mobilization—including from the banking sector—through de-risking instruments as well as innovative structuring of blended finance and credit enhancements. In addition, these institutions also facilitate increased bank lending through co-financing and thematic on-lending. The first issuers of green bonds in many countries, NDFIs have also helped create markets through transaction demonstration effects.

While NDFIs are adopting green finance and climate risk practices (figure B3.4.2), the share of green finance in their portfolios remains low (figure B3.4.3). A survey of NDFIs representing 9 percent of global NDFI assets shows that most institutions include green objectives in their mission or mandate. However, fewer than half have assessed or reported on the impact of climate and environmental risks on their portfolios. The percentage of green assets as a share of NDFIs' portfolios is limited, averaging 14 percent across the sample. To increase green financing, pipeline preparation and private capital mobilization should take center stage. These efforts should be complemented by a better understanding of climate-related financial risks. Enhancing climate-related disclosure and reporting practices is an important mechanism for NDFIs to facilitate communication with clients, beneficiaries, and other stakeholders^b.

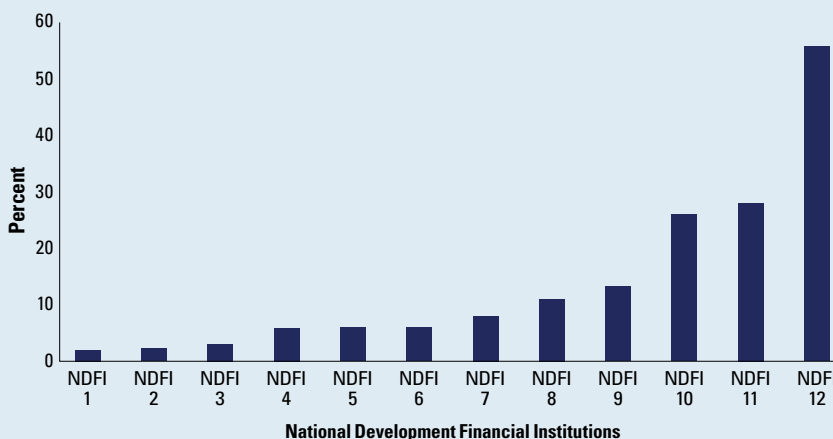
FIGURE B3.4.2 Key Results of Survey Climate Risk Practices among 22 NDFIs (percent of responses)



Source: World Bank Survey.

Note: C&E = climate and environmental; NDFIs = national development financial institutions.

FIGURE B3.4.3 Share of Green Loans in Surveyed NDFIs' Credit Portfolio (percent of total credit)



Source: World Bank 2023a.

Note: Figure B3.4.3 includes the 12 NDFI survey respondents (out of 27) that reported the percentage of green assets in their portfolio. NDFI = national development financial institution.

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- a. NDFIs are defined as any type of financial institution that a national government fully or partially owns or controls, which has been given an explicit legal mandate to reach socioeconomic goals in a region, sector, or market segment. National development banks make up the majority of NDFIs. For an in-depth review on the greening of NDFIs based on a January 2022 survey of 27 NDFIs, see Dalhuijsen et al. (2023).
 - b. The work on greening NDFIs and development banks is accelerated through Finance in Common, the global network of Public Development Banks (PDBs), which aims to align financial flows with climate and sustainable development goals.

As further complements to bank lending, digital financial access and adequate insurance are solutions that can provide protection against climate risk for firms, households, and the financial sector. Lower-income households are disproportionately hit by climate change, yet they have fewer financial options to cope with its impacts, as evidenced by low penetration and financial access rates, which remain a challenge in many EMDEs. Digital financial services, which enable households to send and receive remittances following a climate disaster, build resilience for individuals and families (see chapter 1). Compulsory credit-linked agricultural insurance (Mahul and Stutley 2010) has been shown to help protect farmers and rural banks against climate-related shocks and can also increase rural lending. Such regulatory requirements require careful design, however, and an assessment should be made of potential exclusionary impacts, including those that might result in higher costs for borrowers.

Financial Sector Policy Implications

Following are key policy considerations that banking authorities, other domestic policy makers, and global standard setters should use to evaluate the expanding policy toolbox used in EMDEs, addressing the management of core financial sector stability risks from climate change while enabling support for the mobilization of climate finance.

- 1. EMDE banking authorities need to develop well-functioning green taxonomies, sound data, and strong disclosure standards as key preconditions to successfully address climate issues.** Having a credible, science-based, sustainable taxonomy and a climate disclosure framework in place allows banking and other financial sector authorities to efficiently add climate factors to their existing toolkits. Banking authorities should also support the improvement of banks' climate-related disclosure to the market as increasing transparency will allow investors to make climate-informed capital allocation decisions. For taxonomies and disclosure frameworks to work effectively, authorities must identify and address data gaps that could increase compliance costs and ensure consistency with international standards and market practices while safeguarding coherency with national circumstances and local market development to prevent regulatory overreach. International coordination between regulators should also be strengthened to support interoperability and consistency between national and regional regulatory frameworks to support international capital flows.
- 2. EMDE banking authorities need to proactively manage climate risk by deploying regulatory tools in a sequenced, proportional, and efficient manner while mitigating the potential impacts on financial inclusion.** In line with their core financial stability mandate, EMDE banking authorities need to continue to develop their capacity to assess and manage climate risks in proportion to their overall supervisory capacity and the level of risks they are facing. Not all tools have to be implemented immediately; authorities can start with a simple approach and build over time. Proportionality is also needed when issuing guidance to the banking sector. It is important to recognize that approaches may need to be adjusted to the scale and complexity of firms but should avoid exempting potentially highly exposed, smaller institutions. Authorities need to consider the potential implications that prudential measures intended to enhance stability can have on financial inclusion.
- 3. As they adopt novel approaches to enabling climate finance, EMDE banking authorities must not compromise on their primary financial stability objective.** Some governments are looking to central banks and banking authorities for support in raising climate financing, but they should not infringe on these institutions' operational independence. Banking authorities will need to tread carefully to address

the tensions existing at times between objectives (financial stability, inclusion, and climate finance mobilization), and avoid or mitigate unintended consequences. Some tools could be considered “win-win” and reconcile all three considerations; some are currently “not encouraged”; while for the majority, the “jury’s still out,” and more analysis and evidence is needed to assess their suitability in different contexts. The broad range of new and adapted regulatory tools that support the mobilization of climate finance should fit local contexts and be tailored to address specific barriers that inhibit their functioning. Instead of adopting new tools, authorities are advised to assess how existing instruments can be adapted to integrate green and transition considerations and how they can be applied most effectively on a temporary basis until market failures are resolved.

4. **International networks and standard setters should provide more analysis and guidance on the effective and appropriate deployment of measures that can enable climate finance.** More evidence is needed on how to ensure that financial stability and efficient intermediation and allocation of capital will not be compromised by deploying central bank or supervisory tools that could incentivize banks to lend more to climate-related activities. Guidance will need to carefully consider the context in which EMDE banking authorities are operating, including paying attention to the relative importance of adaptation and nature-related considerations. Further foundational work to improve climate risk modeling methodologies is also required.
5. **Policy makers should deploy complementary tools and reach institutions beyond the banking sector to boost climate finance.** Prudential or central bank measures cannot substitute for broader government interventions. An enabling, long-term climate policy framework and adequate fiscal policies, including targeted subsidies and efficient pricing of carbon emissions, will be needed to align financial incentives and promote the business case for green projects. Complementing the contribution of the banking sector, well-functioning capital and insurance markets, often absent in EMDEs, need to be developed to provide access to long-term funding for critical climate infrastructure and climate-risk resilience instruments. Development banks, credit guarantee institutions, and other NDFIs could also be central to mobilizing private climate finance if deployed judiciously and in a targeted fashion.

Notes: Chapter 3

66. Climate change is part of a broader ecological crisis, which also encompasses other nature-related risks. Like climate change, the degradation of nature and actions aimed at preserving and restoring it will affect economies and financial systems. While recognizing the importance of nature-related risks for EMDEs, this chapter is specifically focused on climate risks.
67. Physical risks relate to the direct impacts from climate change. Transition risks are financial risks that result from the shift to a low-carbon economy driven by changes in policies, technology, market sentiment, or consumer behavior.
68. For a more detailed discussion, see Trust et al. (2023) and box 3.1 on compound risks and adverse feedback loops.
69. Bloomberg New Energy Finance Database 2023.
70. See OECD (2022) for breakdown of Sustainable Development Goal financing. Rozenberg and Fay (2019) discusses the potential size of the infrastructure financing gap in EMDEs.
71. The CDDR investment estimates are based on a 73 percent reduction in GHG emissions by 2050. Investment needs range from less than 1 to 10 percent of GDP and are higher as share of GDP for low-income countries. This is lower than other estimates because it captures only the incremental investment needs compared with a realistic business-as-usual baseline, not the full investment needs for sustainable development. It is also important to note that many CDDR estimates are partial. They include the sectors that cover each country's most important needs, making them good but still conservative proxies for total needs (World Bank 2023d).
72. Total climate finance in EMDEs (ex China) in 2022 amounted to \$193 billion (Buchner et al. 2023).
73. Rockefeller Foundation and Boston Consulting Group (2022) also estimate that just 27 percent of annual climate-financing needs are currently met for EMDEs.
74. Estimates range from \$130 billion to \$415 billion annually. See Buchner et al. (2023) and CPI and GCA (2023).
75. Globally, only 4 percent of reported climate finance is allocated for adaptation purposes, and 98 percent of this financing originates from public sources (Buchner et al. (2023)).
76. Includes banks and non-bank financial institutions (housing, leasing companies, microfinance institutions, and others).
77. If EMDEs and advanced economies are weighted by GDP, the coverage is much closer (44 percent of EMDEs versus 48 percent of advanced economies) as most of the large EMDEs (including China) already have a taxonomy in place, although the largest advanced economy (the United States) does not.
78. The International Sustainability Standards Board's Standards S1 and S2, which cover various metrics, including greenhouse gas emissions, physical and transition risks, climate-related opportunities, and capital deployment, are projected to become a global baseline standard for climate and sustainability disclosure practices.
79. Climate change poses unique challenges to the financial system, given its long-term and complex nature. These challenges require a distinct approach for integrating it into prudential risk management, considering factors such as uncertainty, nonlinear effects, and time-horizon mismatch (EBA 2020; NGFS 2019).
80. EMDE membership in the NGFS has expanded rapidly: from just two of the eight founding members in 2017 to half of the 127 current members.
81. Also discussed in De Haas (2023).
82. Covering banks and non-bank financial institutions (housing, leasing companies, microfinance institutions and others).
83. For example, in fragility, conflict, and violence (FCV) countries, which face foundational challenges linked to gaps in financial intermediation, lack of access to finance, and nonexistent capital markets, climate-related aspects may be less of a priority.
84. See National Bank of Rwanda, Guidelines 2600/2023 on Climate-Related and Environmental Financial Risks Management for Financial Institutions.
85. For a more in-depth discussion, refer to Zetterli (2023).
86. Carvajal and Didier (forthcoming) highlight small and medium enterprises' vulnerability to climate change and limited access to finance, especially for adaptation. They also warn of unintended consequences from financial regulation on financial access.
87. Miguel, Pedraza, and Ruiz-Ortega (2022) provide early insights into the impact of climate and environmental regulatory reforms on financial and real economy outcomes. However, given the novelty of reforms, additional research is needed to establish more conclusive empirical findings.
88. Supporters include the Financial Stability Board, Bank for international Settlements, Basel Committee on Banking Supervision, and International Association of Insurance Supervisors.
89. For an in-depth discussion of climate risks and the macroprudential framework, see ECB/ESRB Project Team (2023) and Hiebert and Monnin (2023). Borrower-based measures include LTV, debt-(service-)to-income, and maturity limits; sectoral SyRB is a capital requirement for the possible materialization of sector-specific systemic risk, to discourage concentrated exposures and increase banks' resilience, while incentivizing banks to make their balance sheets more climate aligned; and concentration thresholds limit exposure to certain geographical areas or sectors. Conversely, the central bank of the Philippines gives an additional 15 percent single borrower limit for lending to or financing green or sustainable projects, effectively relaxing the concentration threshold.
90. In the Netherlands, homeowners can borrow up to a maximum of 106 percent LTV to invest to make their homes more sustainable; see De Nederlandsche Bank (2022).
91. Climate risk may affect both the collateral value and the solvency of borrowers and, therefore, may also affect both the loss given default of the loan and the probability of default of mortgage borrowers. In this context, stricter (looser) ratios could be applied for mortgages based on properties that are more (or less) exposed to physical and transition risks.
92. Central bank and monetary policy tools are discussed in context of their relevance to the banking sector.
93. See NGFS (2021) for a detailed examination of the implications of climate change for a set of central bank tools. In their categorization,

NGFS also discusses asset-purchasing programs, including QE. Green QE may have limited relevance to most EMDEs, because of both a restricted green investment universe and low incidence of QE interventions in most EMDEs, and it is therefore not discussed further in this report.

94. The European Central Bank has also signaled its ambition to explore the greening of TROs, if monetary policy considerations would make it decide to reintroduce this instrument.
95. The Bangko Sentral ng Pilipinas has reduced its reserve requirement rate for green, social, sustainability, or sustainable bonds issued by banks from 3 percent to 0 percent for a period of two years.
96. De Haas (2023) includes a discussion of the potential implications of green supporting factors on financial stability.
97. See Chamberlin and Evain (2021). See also an assessment by the European Banking Authority (EBA 2016) of the reduction in risk weights for small and medium enterprise lending in the EU, which did not point to any measurable increase in credit to such enterprises.
98. Supervisory review of a bank's capital and liquidity position, business model, and internal governance and risk management is covered under Pillar 2 of the Basel Framework—that is, the regulatory standards of the BCBS, which is the primary global standard setter for the prudential regulation of banks. The supervisory review process could result in an increase in capital requirements, for example, owing to shortcomings in climate risk management. Adjusting Pillar 1 requirements to account for climate risks is still posing challenges, including the design, calibration, and interaction with the existing Pillar 1 framework.
99. In 2014, Bangladesh Bank mandated that financial institutions allocate at least 5 percent of their portfolios to green finance. Since 2022, institutions have been asked to dedicate 20 percent to climate change mitigation and adaptation.
100. For further discussion on the potential implications of such policies, see, for example, Khatkhate (1991) and Bezemer et al. (2023).
101. Greenwashing relates to misleading sustainability claims, such as misinformation or misleading communication about green commitments, product attributes, or other climate-related disclosures. Greenwashing is increasingly leading to climate-related litigation risk and is being considered from the perspective of microprudential supervisors, see NGFS (2023b).
102. Sustainable Stock Exchanges Initiative Database, accessed on January 10, 2024.
103. The Guidelines for Integrating Climate Change Mitigation and Adaptation into Public Credit Guarantee Schemes (PCGS) for Small and Medium Enterprises (consultative document) proposes a framework for the greening of PCGS.

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