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MIDDLE EAST AND CENTRAL ASIA DEPARTMENT

# Preparing Financial Sectors for a Green Future

Managing Risks and Securing  
Sustainable Finance

Prepared by an IMF team led by Bozena Radzewicz-Bak and Jérôme Vacher and comprising Gareth Anderson, Filippo Gori, Mahmoud Harb, Yevgeniya Korniyenko, Jiayi Ma, Moheb Malak, Dorothy Nampewo, and Sahra Sakha

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DEPARTMENTAL PAPER

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# Executive Summary

The financial sectors in Middle East and Central Asia (ME&CA) countries should play an important role in supporting climate related policies for the region. The sectors are vulnerable to downside risks from climate-related shocks and at the same time offer potential to help fill the financing gap for needed adaptation and mitigation strategies. Successful approaches to climate change in the region therefore require coherent integration of financial sector strategies within the overall policy framework to meet climate challenges.

To this end, policymakers must ensure that financial sectors are prepared for a green future. Given the significant disparity in savings among countries in the ME&CA region, this calls for a tailored approach. Specifically, in countries with less developed private finance, bolstering financial readiness is crucial. Oil-exporting countries can channel their substantial oil revenues and public savings into climate investment initiatives, while continuing to foster the growth of private green finance. Oil-importing countries should prioritize the development of their capital markets to enhance investment capabilities. Meanwhile, low-income countries and fragile states face a distinct challenge due to their limited financing, while any additional debt issuance might lead to the crowding out of private investment. Nevertheless, they can still focus on mitigating risks within their financial sectors, thereby creating a more conducive environment for future green investments. Each of these strategies is vital in addressing the unique financial landscapes across the ME&CA region.

Specifically, in the near term, policymakers should prioritize a better understanding and measuring of climate-related risks. This includes implementing methodologies for quantifying and reporting such risks, promoting their transparent disclosure by financial institutions, and strengthening frameworks for their forecasting and analyzing. Policymakers should also ensure the adoption of robust climate risk management practices within financial institutions and take steps to develop insurance sectors and leverage reinsurance markets. At the same time, efforts are needed to create a more conducive ecosystem for green finance. Governments should finalize climate strategies, support sustainable finance frameworks, and develop standardized sustainable finance taxonomies.

Over the medium term, governments can support green finance through incentives and market mechanisms, phasing out energy subsidies, and introducing new tools and markets (such as carbon pricing frameworks), which can stimulate demand for investment in green technologies. Similarly, central banks and regulators can provide guidance on integrating green finance into investment decisions and enforcing green investment disclosure standards. They can work toward promoting the deepening of domestic capital markets and identifying and addressing barriers to accelerating green finance. Finally, substantial scope exists for collaboration between public and private sectors within and across regions, including through regional and international initiatives, involving international financial institutions and multilateral development banks, sovereign wealth funds, and state-owned entities to bridge the financing gap for climate investment needs.

The paper offers a unique regional perspective on climate risks in ME&CA's financial sectors and outlines the road ahead in transitioning to a green future. It is the first to evaluate the impact of climate change on banking institutions in the region and assess the capacity of insurance in mitigating climate-related damages and losses. It contributes to the existing literature by synthesizing the size and nature of regional financing needs for adaptation and mitigation and discussing both opportunities and challenges for the development of green finance. The paper's policy recommendations provide guidance to policymakers on how to enhance financial sustainability amid climate change risks.

## Key Findings

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### ***On risks to financial sector stability in the ME&CA region:***

- ME&CA financial sectors are exposed to *physical risks* from climate change. Although past climate disasters in the region have had only moderate impact on banks' performance, limited buffers to deal with climate change shocks (as evidenced by substantial gaps in protection and insurance coverage in the region) could result in large uninsured losses, thus weighing heavily on the economy. With the projected intensification and frequency of climate-related hazards, potential loan losses from physical risks are expected to increase. Our analysis indicates the combined cumulative loan losses of banking sectors of 30 ME&CA countries could reach \$11 billion by 2030 and approximately \$50 billion by 2050 (in 2021 prices), or around 1 to 1.5 percent of the region's total bank assets in 2021.
- The materialization of *transition risks* in the region could have adverse systemic implications. The ME&CA region's economic sectors exhibit higher emissions intensity compared to the median for emerging market countries. Banks with larger credit exposures to high emission sectors (for example, utilities, transportation, manufacturing, and agriculture) are more vulnerable to decarbonization efforts, with oil-exporting countries and the Caucasus and Central Asia region facing heightened vulnerability to these risks. Stress tests at the firm level indicate that substantive mitigation measures (proxied by a one-time increase in the carbon price) could result in bank capital losses ranging from \$70 billion (2.5 percent of GDP) to \$140 billion (5.0 percent of GDP).
- Insufficient insurance capacity in the ME&CA region results in public sectors and other entities bearing uninsured damages and losses from climate-related shocks. The region's dependency on the reinsurance market is growing and has become more competitive. This presents an opportunity for the primary insurance market to diversify its insurance portfolio, potentially acting as a catalyst for increasing primary insurance coverage for climate-related disasters.

### ***On the ME&CA region's investment needs for climate change mitigation and adaptation and private and green climate finance development:***

- The supply of green finance in ME&CA countries is gradually increasing, yet it remains small when compared to the region's significant financing needs for climate mitigation and adaptation investment. In particular, private climate finance in the ME&CA region is limited compared to other regions, with only around 0.2 percent of GDP originating from domestic financial institutions and markets. Green finance is at an early stage of development and is highly concentrated in just a few countries in the region, primarily within the Gulf Cooperation Council. By comparison, the expressed official multiyear financing needs total at least \$1 trillion dollars by 2030, and according to some estimates, these financing needs may even surpass \$2.6 to \$3.1 trillion by 2030. Low-income and fragile states, as well as countries with underdeveloped financial sectors, report higher investment needs relative to their GDP.

### ***On the financial sector's role in financing green transition and attracting more private climate investment in the region:***

- There are significant opportunities for ME&CA domestic financial sectors to develop their role in climate finance. Recent financial innovations in the region, a surge in green bond issuance, and a prominent role played by sovereign wealth funds in oil-exporting countries offer encouraging signs that some large mitigation projects can be financed solely with nonpublic capital or through public-private partnerships. Domestic banking sectors have a comparative advantage in further channeling savings and providing finance for green investments in some specific segments (for example, small and medium-sized enterprises and households) and areas (for example, energy efficiency) given their knowledge of local borrowers. In

oil-exporting countries, developing climate finance early on is one of the avenues to help sever the strong link between bank funding and hydrocarbon prices. It will also help in reducing challenges to financing climate initiatives over the medium term and in lowering exposure to transition risks.



## Acronyms and Abbreviations

CCA	Caucasus and Central Asia
ESG	environmental, social, and governance
FSR	Financial Stability Report
GCC	Gulf Cooperation Council
GHG	greenhouse gases
ICR	interest coverage ratio
IFI	international financial institution
ME&CA	Middle East and Central Asia
MENA	Middle East and North Africa
MENAP	Middle East, North Africa, Afghanistan, and Pakistan
NDC	nationally determined contribution
PPP	public-private partnership
SOE	state-owned enterprise
SWF	sovereign wealth fund

# Glossary

**Adaptation** Actions that reduce the negative impact of actual or expected harmful climatic events on the environment, economy, and social fabric, or making the most of any potential beneficial opportunities for human and society.

**Climate bonds** A subset of green bonds (see “green bonds”) that specifically focus on projects that address climate change mitigation and adaptation.

**Climate change** Long-term shifts in temperatures and weather patterns, attributed directly or indirectly to human activity that alter the composition of the global atmosphere, in addition to natural climate variability in the solar cycle.

**Climate finance** Refers to local, national, or international financing from public and private sources to support mitigation and adaptation actions that will combat climate change, including efforts to reduce carbon emissions, support vulnerable communities affected by climate change, climate-related research, as well as climate disaster preparedness, among others.

**Climate investment** The allocation of financial resources toward projects, activities, and initiatives that contribute to tackling climate change and its impacts. They include investment in renewable energy, energy efficiency, sustainable transportation, clean technologies, and climate sustainable infrastructure that helps communities adapt to climate change.

**Climate scenario** A plausible representation of how the future can develop based on a coherent and internally consistent set of assumptions about the key drivers of climate change based on, for example, the rate of technological change, prices, and regulatory frameworks.

**Disaster** Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response.

**Environmental, social, and governance** Framework that incorporates environmental, social, and governance factors into investment decision making. It recognizes that climate finance should not only consider financial returns, but also the environmental impacts, and takes the following into account: greenhouse gas emissions, resource usage, and climate change mitigation and adaptation efforts.

**Green bonds** Green bonds are debt securities issued by governments, municipalities, corporations, or other organizations to finance projects that have positive environmental impacts.

**Green finance** It entails the incorporation of environmental factors and sustainability principles into financial services, products, and decisions. This encompasses both (1) directing resources toward ecologically beneficial projects and (2) incorporating environmental risk assessment into financial decision-making processes.

**Greenhouse gases** Gases in the Earth’s atmosphere that absorb infrared radiation of certain wavelengths from the Sun and release it. The more of these gases exist, the more heat cannot escape into space, and consequently, the more the earth heats up.

**Green investment** Refers to the allocation of financial resources to projects, businesses, and initiatives that have positive environmental impacts. These investments are made with the intention of promoting sustainability, reducing carbon emissions, conserving resources, and addressing environmental challenges.

**Greenwashing** Misleading practices to create a false impression of environmental responsibility or commitment to climate-friendly initiatives, often to attract investments or improve public perception. They include exaggerating the environmental benefits of financial products or underreporting the climate impact of investments.

**Liability risk** The risk that arises from potential future compensation claims that insurers and reinsurers face against policyholders failing to manage climate-related risks.

**Mitigation** Actions that reduce the flow of heat trapping greenhouse gases into the atmosphere by reducing the sources of these gases (for example, burning fossil fuels) or by increasing the places to “store” them and thus allowing for their greater accumulation.

**Patient capital** Refers to long-term capital, where investors are willing to forgo immediate profits in anticipation of greater returns in the future. Rather than seeking quick gains, patient capital emphasizes the importance of sustainable and enduring outcomes.

**Physical risk** The risk that results from the economic costs of climate-related events. It is typically grouped into two categories: acute and chronic. Acute physical risk results from extreme weather events and natural disasters such as floods, wildfires, hurricanes, heavy precipitation and storms, and heatwaves, while chronic physical risk arises from longer-term changes in climate patterns, such as rising average temperatures, sea level rise, desertification, and ocean acidification.

**Stranded assets** Physical assets that are economically unviable to exploit and must be written off. This is particularly pertinent to fossil fuel-based assets that may become unprofitable or obsolete as the global economy transitions towards low-carbon alternatives.

**Tippling point** In the case of climate change, it refers to a critical threshold when global or regional climate changes from one stable state to another stable state does not return to the initial state, even if the drivers of the change abate.

**Transition risk** The economic and financial impact resulting from the introduction of climate policies to reduce carbon dioxide emissions, technological advances, and changes in consumer sentiment on high-emitting firms, sectors, and economies.

# 1. Introduction

Countries in the Middle East and Central Asia (ME&CA) face increasing vulnerabilities to climate change risks, which could carry implications for their populations, economies, and financial systems. Even with greenhouse gas (GHG) emission reductions, scientists predict that climate-related natural disasters will increase in frequency and severity, posing considerable risks to ME&CA's economies and living conditions (Lelieveld and others 2016). These risks range from damages to infrastructure and properties, to lower agricultural yields and productivity, and a deterioration in public health and higher mortality. Climate-related events will drive repair and labor costs, shifting economic incentives, with repercussions for the value of physical and financial assets, as well as company and household incomes (Duenwald and others 2022). Moreover, ME&CA's high reliance on oil and gas production and exposure to carbon-intensive industries make the region particularly susceptible to transition risks, including disruptions in fossil fuel trade and stranded assets.

To address these, countries need to adjust through a combination of adaptation and mitigation policies, tailored to their individual circumstances, including the relative reliance on hydrocarbon extraction and energy intensity. While mitigation should be a policy priority in the region, adaptation is an immediate challenge for most ME&CA countries as the region is already harshly affected by intensifying weather hazards. At the same time, countries' climate adaptation and mitigation strategies require substantial investment that governments will not be able to fund in its totality given multiple spending priorities and a limited fiscal envelope, putting a premium on private sector financing, and developing a strong and vibrant green finance marketplace.

Against this background, financial sectors and their supervisors have an important role to play in both monitoring and managing risks to financial stability, as well as in harnessing the potential for sufficient climate finance. This involves enhancing the resilience of financial sectors against physical and transitional risks and creating an enabling environment for private finance and developing a robust financial ecosystem. In this context, the paper examines the potential impacts of climate-related risks on financial sectors of ME&CA countries and considers how these countries can mobilize the necessary financing needed to meet climate objectives. Specifically, the paper addresses three questions: (1) What are the risks to financial sector stability in the ME&CA region from climate change? (2) What are the ME&CA region's investment needs for climate change mitigation and adaptation? (3) How can the financial sector's role be leveraged to attract more private climate investment in the region?

The rest of the paper is organized as follows. Chapter 2 analyzes banks' exposure to climate-vulnerable economic sectors and assesses potential impacts of climate disasters (physical risks) and emission cost increases (transition risks) on banks in the region. The section also examines the insurance sector's vulnerability to climate change risks and its ability to provide buffers against climate-related disasters. Chapter 3 takes stock of the identified and projected financing needs for climate change mitigation and adaptation in the ME&CA region and examines the magnitude of these needs relative to the level of development and depth of the country's financial system. Chapter 4 summarizes the evolution of green finance in the ME&CA region and the financing options available for green investments. It highlights the challenges and opportunities for deepening the green finance markets and seeks to answer the question of what is needed to make domestic financial sectors play a greater role in supporting the transition to a green future. Lastly, Chapter 5 concludes with sequenced policy options for policymakers, financial institutions, and other stakeholders, aimed at fostering an environment that encourages greater participation of financial institutions in climate finance and facilitates the transition toward a green future.



## 2. Facing the Challenges: Climate Change Risks in the Financial Sector

Climate change presents risks to the financial sectors in the ME&CA region. Rising temperatures result in more frequent and severe climate disasters which could damage assets, disrupt vital operations, and lead to financial losses. Limited insurance penetration in the region provides weak buffers against large climate disasters, placing a heavy burden on the economy, public finances, and the financial sector itself. Banks in the region are vulnerable to climate change risks due to their exposure to carbon-intensive industries, as well as investment and financing of extractive industries amid growing concerns about potential stranded assets as the world shifts toward renewable energy sources.

### A. Climate Change Risks and Bank Stability Nexus in the ME&CA Region

---

Two sources of climate change risks could affect banking sector stability:

- *Physical risks:* These arise from (1) extreme weather shocks (acute risks) and (2) gradual changes in climate patterns (chronic risks) (NGFS 2019). Through damage to physical and human capital, disruption in production and supply chains, and rapid changes in asset valuation, the realization of these risks can have wide-ranging impacts on the government sector, firms (including financial institutions), and households, causing significant economic and financial losses. Financial institutions, including banks, are exposed directly to these losses through disruption of their internal systems, processes, and physical assets (operational risks), as well as their lending activities and portfolio holdings (IMF 2020). In addition, banks can be affected by elevated liquidity risks from abrupt deposit withdrawals or increased demand for credit lines, while the repricing of financial instruments can lead to heightened market risks.
- *Transition risks:* These include changes in technologies, regulations, and other climate-related policies that are integral to the adaptation process to a low-carbon economy. They also encompass shifts in consumer preferences and investor sentiment away from carbon-intensive companies and sectors, which can affect their financing conditions, potentially leading to their higher operating costs, weaker profitability, and asset repricing. Transition risks also include the possibility of stranded assets and litigation risks against companies causing environmental harm. Potentially higher legal and regulatory requirements resulting from climate-related risks imposed on financial institutions will translate into higher operational costs for these institutions. Transition risks are more pronounced if the transition to a low-carbon economy occurs too late or too abruptly.<sup>1</sup>

The interaction of physical and transition climate risks and how they might impact banks in the region remains subject to considerable uncertainty (Figure 1). The understanding of different sources of climate risks, their interplay, and transmission channels is still in its early stages. An early transition is expected to mitigate some of the risks to financial stability (although ME&CA countries will continue to face risks from the intensification of climate hazards), while a delayed and abrupt transition might trigger repricing of assets, thereby increasing financial stability risks. Moreover, physical and transition risks can unfold in parallel, compounding these challenges (NGFS 2020a, NGFS 2020b). This would create potential for spillovers that

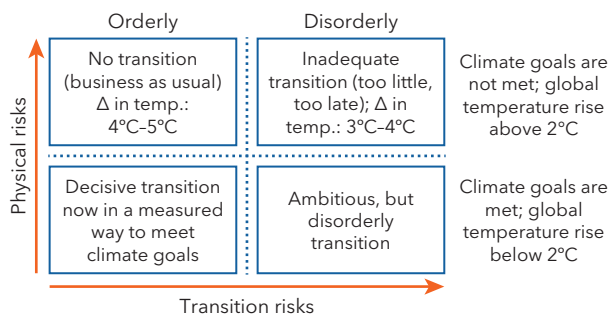
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<sup>1</sup> Transition risks to the financial sector can be mitigated at the sovereign level by implementing timely, credible, and smooth transition policies. It is the late and sudden transitions that pose financial stability risks and should be avoided.

could disrupt the functioning of multiple segments of the financial system at the same time. Alternatively, localized climate shocks, which have been so far predominant in ME&CA region, may only affect specific asset classes, particular economic sectors, or subregions, without posing systemic risks.

Climate change has the potential to amplify existing vulnerabilities in the financial sectors of the ME&CA region. Climate-related risks can exacerbate underlying vulnerabilities, especially in smaller and more concentrated banking sectors and those exposed to climate-sensitive industries like agriculture (Afghanistan, Caucasus and Central Asia [CCA], Pakistan, and Iran), real estate (countries in the Gulf Cooperation Council [GCC]), tourism (Egypt, Jordan, Morocco, Lebanon, Tunisia, the United Arab Emirates, and West Bank

**Figure 1. Orderly and Disorderly Scenarios for Unfolding Physical and Transition Risks and Their Interaction**



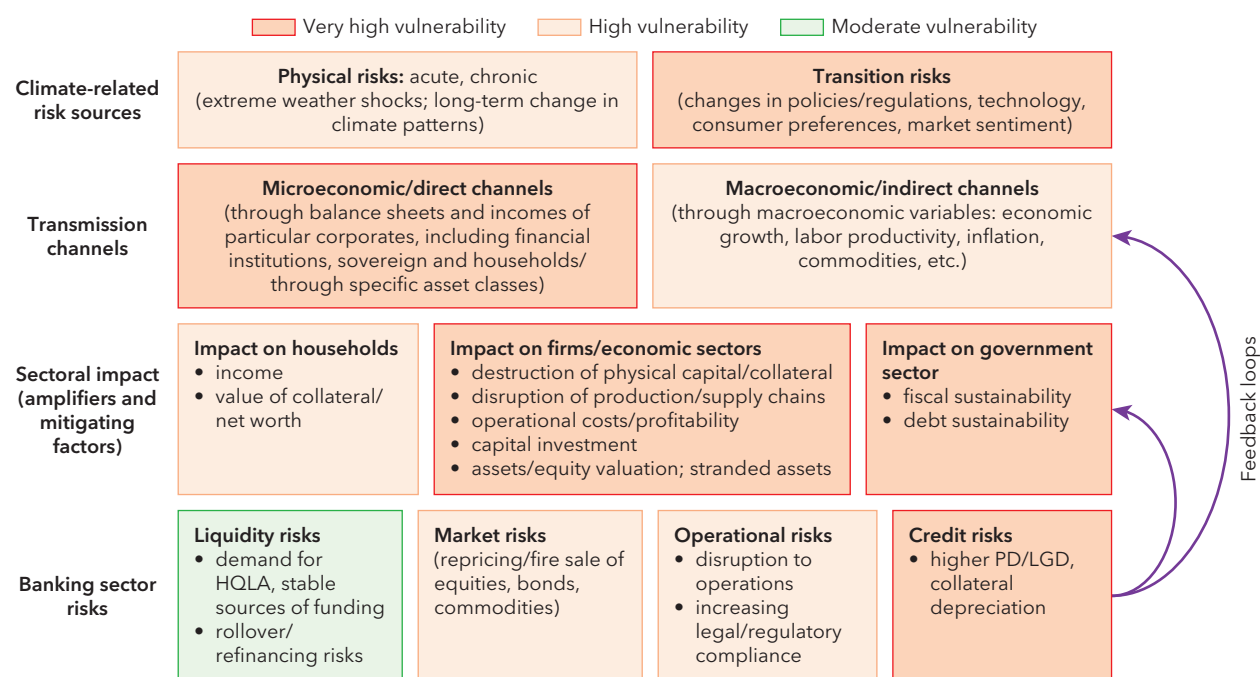
Source: NGFS (2019).

and Gaza), and carbon-intensive sectors (oil exporters). These features can lead to higher funding costs and hinder financial intermediation, including the availability and accessibility of credit. Additionally, climate-induced shocks could heighten systemic risks for banks through the legacy of problem loans (Iran, Jordan, Pakistan, Tunisia, and Uzbekistan) and cause large swings in credit cycles associated with climate disasters. The realization of climate shocks could also elevate pressure on exchange rates, for example in countries more dependent on food imports, or in countries with a high level of dollarization (Afghanistan, Georgia, Iraq, Jordan, Kyrgyzstan, Lebanon, Tajikistan, and Uzbekistan) or limited international reserves,

thereby amplifying banking sector vulnerabilities. Moreover, banks with stringent credit requirements (Teodoru and Akepanidaworn 2022; in Armenia, Azerbaijan, Kyrgyzstan, Georgia) and insufficient proactive credit restructuring policies may face challenges during the post-climate-shock recovery process, as these will likely inhibit their operations.

Climate change risks could have severe implications for the financial sectors in low-income and developing ME&CA economies. Among the 10 largest climate disasters in the region since 2000, 7 occurred in low-income and developing countries (Duenwald and others 2022). These countries are particularly vulnerable to the effects of climate change as they rely more heavily on agriculture, fishing, and tourism for their livelihoods. Limited economic diversification and the resultant loss of vital economic drivers can escalate poverty, unemployment, and food insecurity, making it more challenging to rebound from climate-related disasters. With underdeveloped financial sectors, access to capital and insurance is more constrained, hampering investment in climate-resilient infrastructure by the public and private sectors. Consequently, this increases economic and financial stability risks, which could reduce development and growth prospects, further contributing to poverty and macro-financial vulnerabilities.

In the ME&CA region, potential sources of systemic risks primarily arise from transition risks, particularly for oil exporters and CCA, and reflect direct exposures to carbon-intensive sectors (Figure 2). The region seems more vulnerable through direct channels where the bank balance sheets are affected via their credit exposures and investments, while indirect channels (including economic growth, labor productivity, and sovereign credit ratings), which affect financial institutions through the economic environment in which they operate, seem to be less at play. However, the materialization of climate risks can curtail banks' lending capacity, leading to decreased investment, consumption, and weaker growth prospects. This lower lending capacity of banks will mainly affect sectors and firms that rely on bank credit, but also the public sector

**Figure 2. Climate Risks and Transmission Channels to the Banking Sector Risks in the ME&CA Region**

Sources: Ehlers, Gao, and Packer (2021); European Central Bank (2022); and IMF staff.

Note: This is a relative assessment and not a quantification of risk. HQLA = High-Quality Liquid Asset; LGD = Loss Given Default; ME&CA = Middle East and Central Asia; PD = Probability of Default.

(including state-owned enterprises that borrow to finance their investment and operations), thus creating negative feedback loops. Similar to other regions, the interplay between direct and indirect channels and the economy and financial system can potentially amplify these effects.

## B. Impact from Physical Risks on Banks in the ME&CA Region

### The Evolution of Physical Risks in the Region

The ME&CA region faces diverse climate change risks and extreme weather events. Since the turn of the millennium, floods have been the most common disaster, accounting for about two-thirds of all climate-related events, followed by storms, droughts, and extreme temperatures (Figure 3).<sup>2</sup> Droughts and extreme temperatures prevail in the Middle East, North Africa, Afghanistan, and Pakistan (MENAP) subregion, while floods, storms, and landslides occur in the CCA.<sup>3</sup> The distribution of climate events exhibits a long right tail, indicating that majority of them resulted in moderate economic losses, but a few catastrophes were extremely costly, beyond the devastating human impacts. Among the climate disasters for which data is

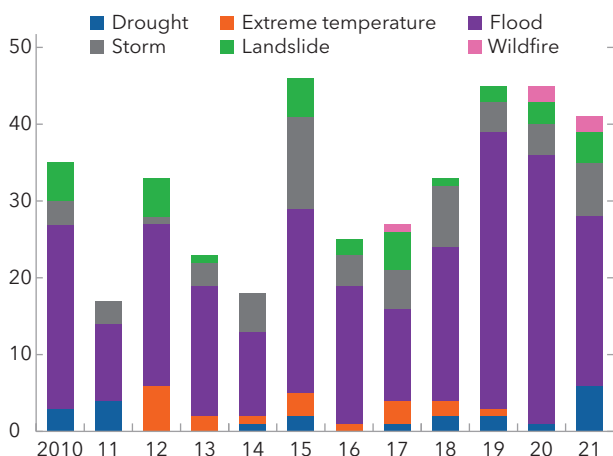
<sup>2</sup> Storms contribute to 13 percent of the region's total climate disasters, while droughts and extreme temperatures account for 5 percent each.

<sup>3</sup> Some countries in the region are facing particularly high rates of climate disasters. For example, both Afghanistan and Pakistan have witnessed climate-related disasters accounting for about 16 percent of all climate events since 2000, with floods alone accounting for two-thirds of these events. Moreover, Afghanistan, Mauritania, and Somalia together have contributed to about half of the droughts observed in the region.

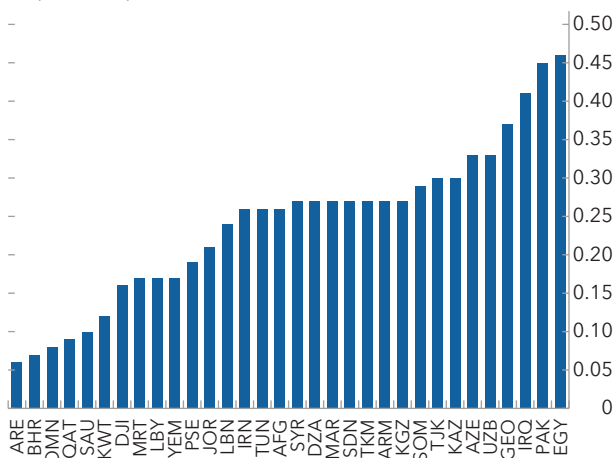


**Figure 3. Physical Risks in the ME&CA Region**

**1. Climate Events in the ME&CA Region since 2010**  
(Number of events, by type)



**2. Projected Proportion of Population Susceptible to Floods in 2040**  
(Percent)



Sources: EM-DAT; Moody's ESG Solutions/Four Twenty Seven; and IMF staff.  
Note: ME&CA = Middle East and Central Asia.

available, around 41 percent incurred expenses below \$10 million, but a small fraction of events (approximately 5 percent) exceeded \$1 billion in losses and damages. Noteworthy examples include the devastating flash floods in Pakistan in 2010 and 2022, and the destructive tropical cyclone in Oman in 2007.<sup>4</sup>

Future climate risks are expected to increase, despite ongoing mitigation efforts. The region is projected to experience intensified climate stress, including rising temperatures, unpredictable precipitation patterns, and more frequent and severe climate disasters (Duenwald and others 2022). Even under moderate emissions scenarios, most countries in the region will witness an increase in heavy precipitation events (Figure 4). Additionally, the MENAP population will face higher heat stress and the CCA subregion may experience more floods, exacerbating water stress concerns. This is especially important for water-dependent countries both in MENAP and CCA, particularly Iran, Iraq, Jordan, West Bank and Gaza, and Yemen.

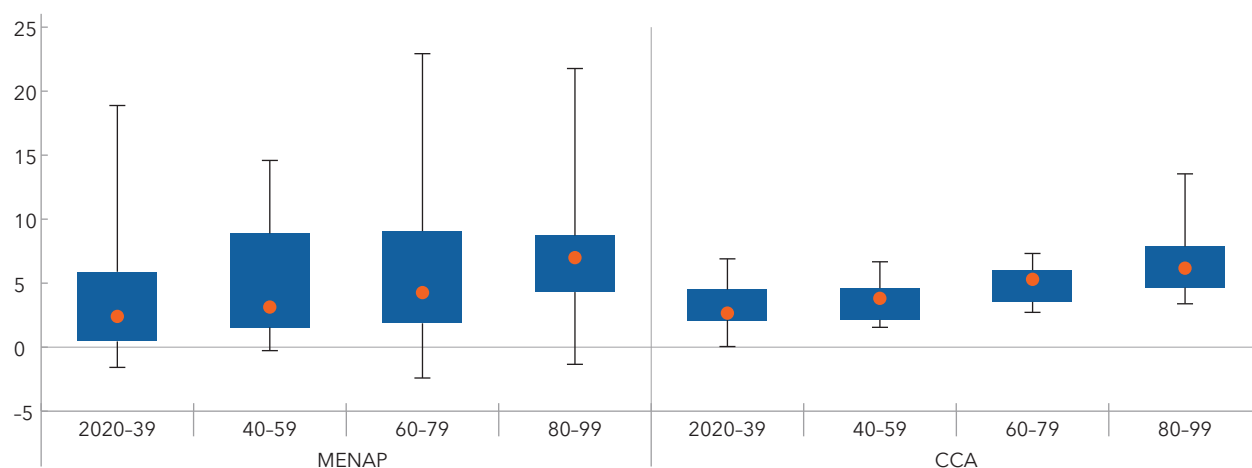
In the ME&CA region, policymakers are beginning to measure and assess the potential implications of climate change-related risks on their financial systems (Box 1). The objective is to increase the resilience of financial sectors to climate shocks, but this work is still at an early stage.

### The Impact of Climate Disasters on ME&CA Banks

The extent to which climate disasters transmit to ME&CA financial sectors will hinge on two critical factors: the prevalence of climate hazards and the level of exposure that banks have to the sectors most affected. Agriculture and tourism are particularly susceptible to climate-related shocks, whereas industry and construction can suffer from reduced water and electricity supply that accompany climate disasters (Duenwald and others 2022). Although commercial banks' direct credit exposure to the agricultural sector is relatively limited (see the later discussion on transition risks), and this appears to provide some insulation for the financial sector against the acute impacts that this sector may face from climate disasters, sustained disruptions could spillover and hamper the productivity of other sectors to which banks have higher credit

<sup>4</sup> The flash floods in Pakistan in 2010 and 2022 resulted in economic damages and losses of approximately \$9.7 billion and an estimated \$30 billion, respectively (based on a Post-Disaster Needs Assessment conducted by the Pakistani Government with support from the United Nations, World Bank, African Development Bank, and the European Union). The economic costs associated with Cyclone Gonu only in Oman surpassed \$4 billion in 2007.

**Figure 4. Projected Median Increase in the Largest Five-day Cumulative Precipitation**  
(Change in millions relative to the reference period 1986–2005, RCP 4.5 scenario)



Sources: Duenwald and others (2022); World Bank; and IMF staff calculations.

Note: The dots show projections of the median changes in the largest five-day cumulative precipitation region relative to the period 1986–2005 in each region, the boxes show the range of the 10th and 90th percentiles, and the whiskers show the minimum and the maximum. Representative concentration pathway (RCP) 4.5 is a moderate emissions scenario. CCA = Caucasus and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

exposures. Furthermore, banks' larger exposures to the manufacturing and services sectors render them particularly vulnerable to disasters that disrupt the provision of essential services and infrastructure, extensively relied upon by these sectors.

Based on our analysis, physical risks have had a moderate impact on banks' balance sheets in the ME&CA region (see Annex 1 on methodology).<sup>5</sup> Moreover, estimates of the magnitude of climate disasters on bank performance suggest that individual shocks are unlikely to give rise to systemic risk if they materialize in a healthy banking sector (Figure 5; Box 2). On the other hand, climate-related disasters have the potential to pose more significant systemic risks if they transpire during a period of preexisting financial distress, or if their realization and severity increase over time. Specifically<sup>6</sup>:

- **Impact on asset quality:** In US dollars, each disaster year was estimated to cause an average reduction of approximately \$250 million in bank credit.<sup>7</sup> On average, climate disasters have increased the nonperforming loan ratios of banks by about 1.4 percentage points.
- **Pass-through of disaster damage to credit losses:** The impact of climate disasters on banks' credit losses in US dollars is estimated at about 23 cents for every US dollar of total damage caused. This result suggests a relatively high pass-through of disaster damage to banks' credit losses, possibly reflecting limited insurance market penetration in ME&CA countries, as well as limited government disaster relief plans.

<sup>5</sup> This section aims to complement the work undertaken by some central banks and regulators across the region, as discussed in Box 1, by analyzing the impact of acute physical risks on the health and performance of the banking sector.

<sup>6</sup> While the analysis focuses on measuring physical risks through credit losses and the feedback to profitability and capital adequacy, climate events can also contribute to operational disruptions that could have long-term adverse effects on the reputation and operational capacity of banks in climate-affected areas.

<sup>7</sup> This means that between 1980 to 2021, climate change-related disasters could have cost ME&CA's banking sectors about \$37 billion.

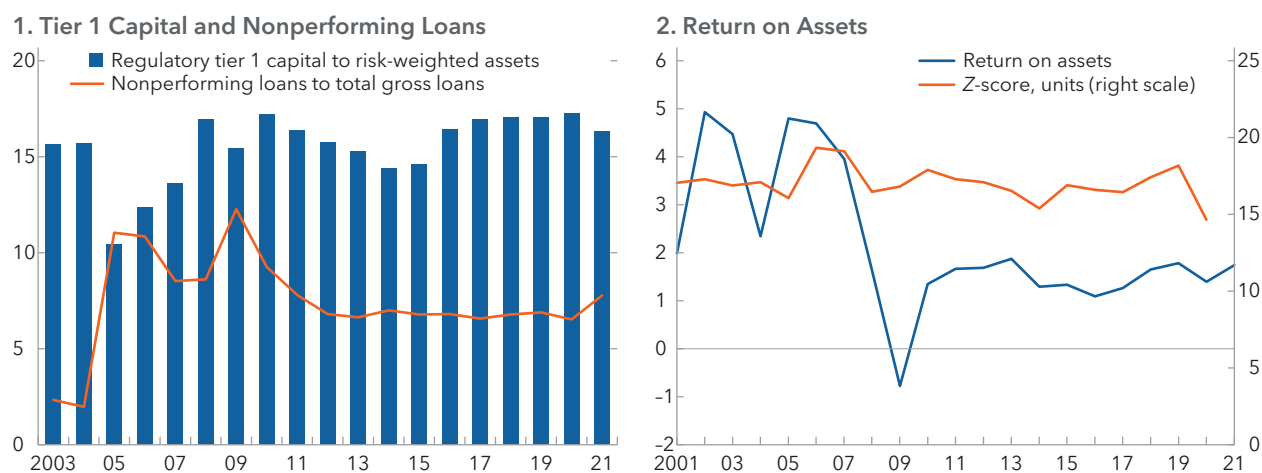
### Box 1. Climate Risk Analysis in ME&CA Financial Stability Reports

Policymakers in the Middle East and Central Asia (ME&CA) region have begun to examine the impact of climate disasters on their financial systems. Recognizing the growing exposure to climate hazards, central banks and financial supervisors are taking steps to integrate climate-related risks into their analytical frameworks and decision-making processes to ensure the stability of their financial systems. This entails evaluating the exposure of assets and liabilities to physical and transition risks related to climate change, as well as establishing robust contingency plans within financial institutions. Although this process is still in its initial phase within the region, there are notable examples that demonstrate progress in this area. For example:

- The State Bank of Pakistan (2021) has identified its agricultural sector as particularly vulnerable to climate risks. Although the exposure of financial institutions to agriculture remains relatively small, the importance of this sector and its interlinkages with the rest of the economy may have much broader repercussions on the financial sector in the event of a climate disaster than direct credit exposures would suggest.
- The Central Bank of Oman has developed a systemic index that specifically targets the identification of environmental and climate change risks. In its 2022 financial stability report (FSR), the central bank conducted an assessment and determined that these risks possess a considerable likelihood of materializing, with their potential impact on the economy varying from “high” to “very high.”
- Bank Al-Maghrib (Morocco) in 2021 published a roadmap to tackle financial stability risks arising from climate change. Similarly, the Central Bank of Egypt integrated an analysis on the repercussions of a climate shock scenario for the financial system. Furthermore, the United Arab Emirates’ FSRs encompass a segment devoted to climate risk scenarios, while the Saudi Central Bank is currently integrating both physical and transition risks into its forthcoming financial stability reviews.
- Similarly, in various Caucasus and Central Asia countries, FSRs explicitly discussed climate change risks. For instance, Armenia’s Central Bank featured a climate risk section, collaborating with the German Sparkasse Stiftung for International Cooperation to develop climate risk assessment tools like Risk Radar and Heat Map. In Turkmenistan’s 2022 FSR, a dedicated box covered climate risk and sustainable finance policies within financial stability policy measures. The Central Bank of Uzbekistan heightened awareness by explaining physical and transition risks from climate change. Azerbaijan’s Central Bank endorsed a Sustainable Finance Roadmap in their 2022 FSRs, ensuring climate and environmental, social, and governance resilience. Georgia’s financial sector embraced climate concerns through issuing its corporate governance code and upcoming environmental, social, and governance integration guidelines, offering tools for managing climate risks.

Awareness also appears to be increasing within financial institutions. For example, a climate-related risk survey undertaken by the Central Bank of United Arab Emirates found that 45 percent of its banks engage in discussions on climate risks with their boards and 22 percent had integrated climate risks into their risk management frameworks, with most other banks plan to follow suit in the future. In Jordan, following the government’s directives, banks are expected to conduct climate change-related stress tests.

**Figure 5. On Average, ME&CA Banks Appear to Be Able to Withstand a Single Climate-Related Disaster (Percent)**



Source: IMF, Monetary and Financial Statistics database.

Note: Countries included in the sample in panel 1 are Afghanistan, Armenia, Azerbaijan, Bahrain, Djibouti, Georgia, Jordan, Kazakhstan, Kuwait, Mauritania, Sudan, Syria, Tajikistan, Turkmenistan, United Arab Emirates, Uzbekistan, and Yemen; countries included in the sample in panel 2 are Algeria, Armenia, Azerbaijan, Djibouti, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Pakistan, Saudi Arabia, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan.

- **Impact on banks' credit loss provisions:** In the ME&CA region, climate disasters have had a positive and significant impact on banks' credit loss provisions.<sup>8</sup> On average, provisions for credit losses have increased by 20 percent in the year following a disaster.
- **Impact on bank profitability:** Rising bank credit loss provisions following a climate disaster decrease the overall profitability of affected institutions. Quantitatively, in a disaster year, the return on assets of ME&CA banks falls by an average of about 0.6 percentage point.
- **Impact on banks' liquidity:** In principle, climate disasters could create large reconstruction needs and increase the demand for deposit withdrawals from banks, thereby adversely affecting bank liquidity. However, the impact of previous climate disasters on bank liquidity (measured as the ratio of bank liquid assets to short-term liabilities) does not indicate that this is a significant channel in the ME&CA region.
- **Impact on banks' capital adequacy:** If banks suffer significant losses because of climate-related events, this can adversely affect their capitalization. The impact of climate events on the capital adequacy ratio (measured by Tier 1 capital to risk-weighted assets) provides tentative evidence that climate events impact negatively capital adequacy, with a decline in capital adequacy of around 0.8 percentage point in the year following a disaster, though the effect is not statistically significant.

<sup>8</sup> Droughts, extreme temperature events, and floods were found to be positively associated with an increase in bank loan loss provisions in the year following a climate event in both the MENAP and CCA regions. Other climate-related disasters (landslides and storms) appear to have no statistically significant impacts on bank provisioning. Quantitatively, the occurrence of a drought in a given year increases bank credit provisions by about 21 percent on average in the ME&CA region as a whole, but with large differences between the two subregions (MENAP and CCA), while the occurrence of an extreme temperature event increases bank provisioning by about 16 percent. Floods, on average, increase bank credit provisions by about 10 percent on average for the ME&CA region.

## Box 2. Bank Stock Returns around Climate Disasters

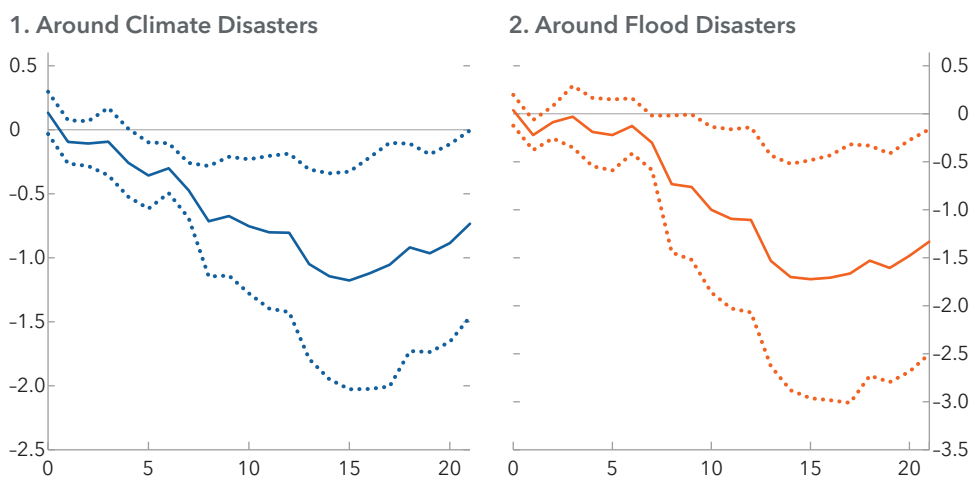
Assessing the response of stock prices to climate disasters is an additional way to gauge whether large climate disasters expose banks to financial stability concerns, given the destruction of banks' assets, operational capacity, and a potential decline in demand for their products and services. The change in bank stock prices can therefore be viewed as a summary measure of how disasters affect these institutions through credit, liquidity, market, and operational risks (IMF 2020).

To examine the stock price performance of Middle East and Central Asia banks around climate disasters, the following specification is estimated:

$$r_{i,c,t+h} = \alpha_i + \gamma_c + \delta_t + \beta D_{c,t} + \varepsilon_{t+h}^1$$

The coefficient of interest,  $\beta$ , shows the average effect on stock price returns for banks in a country where a climate disaster occurs, relative to those banks in countries without a disaster. Box Figure 2.1, panel 1, shows the response of banks' stock prices following a disaster. The results suggest modestly lower returns for banks in disaster countries, relative to those banks not subject to an in-country disaster, with cumulative returns around 1 percent lower three weeks (15 business days) after the shock.

**Box Figure 2.1. Cumulative Return for ME&CA Banks**  
(Percent)



Sources: IMF staff calculations.

Note: ME&CA = Middle East and Central Asia.

<sup>1</sup> Where  $r_{i,c,t+h}$  is the cumulative return of bank  $i$ 's stock price between day  $t+h$  and day  $t-1$ ,  $\alpha_i$  is a bank fixed effect,  $\gamma_c$  is a country fixed effect,  $\delta_t$  is a day fixed effect, and  $D_{c,t}$  is an indicator variable equal to 1 if there is a climate disaster in country  $c$  on day  $t$  and zero otherwise. Days on which there are no disasters in any of the countries considered ( $D_{c,t}$  is equal to zero for all countries) are excluded from the sample. Daily bank stock price data is sourced from Refinitiv Eikon covering 173 banks in 16 countries. Climate disaster data is sourced from EM-DAT, including floods, droughts, and landslides.

## Box 2. (continued)

Box Figure 2.1, panel 2, shows the response of banks' stock prices following floods, which are the most common disaster for the region, and arguably one of the most likely to impact valuations at high frequency.<sup>2</sup> The profile of returns is similar to Box Figure 2.1, panel 1, but slightly more negative, with cumulative returns around 1.7 percent lower around three weeks after the flood relative to returns for banks in countries not subject to a flood. The estimated impact is significant but modest, particularly relative to the volatility of stock returns in emerging markets (Aggarwal and others 1999). The full impact on stock returns could be larger if market participants react to forecasts of weather disasters in the days preceding the event (Campiglio and others 2023) and the impact may also extend beyond the narrow three-week window considered here. Biases in the estimates may also arise from the staggered timing of natural disasters and heterogeneity in the impact of disasters (for example, Baker and others 2022).

<sup>2</sup> To examine whether the negative cumulative returns are driven by overall stock market declines in countries hit by a disaster, an additional specification is estimated which considers the cumulative abnormal returns of banking stocks—measured as returns in excess of those predicted by local stock market movements. The estimates show that the cumulative abnormal returns of banks in disaster countries are not significantly different from those in nondisaster countries, suggesting that the lower cumulative returns that banks experience in disaster countries could reflect overall weaker stock market performance in those countries.

- *Regional variation:* The results vary widely by subregion. An increase in droughts by one standard deviation has a significantly greater (over twofold) impact on provisions in CCA than MENAP. This outcome may arise from various factors, including cross-regional differences in adaptive measures, variations in insurance sector penetration, differences in government bailout policies, and possible differences in the severity of such events or their implications for the respective economies.<sup>9</sup>

ME&CA banks appear to be able to withstand a single climate-related shock if it materializes in a sound banking sector. On average, the ME&CA region has maintained bank Tier 1 capital levels ranging from around 10 to 17 percent of risk-weighted assets since 2003,<sup>10</sup> while the z-scores ranged between 15 to 19 standard deviations. Both metrics appear to be sufficiently high to permit the absorption of losses associated with climate events. However, the occurrence of climate-related disasters could be more consequential for weaker banks, potentially posing tangible systemic risks if they emerge during a period of preexisting financial distress or if their frequency and intensity increase over time.

Our findings align broadly with estimates derived from similar methodologies that focus on comparable countries. However, comparing the results in this paper with corresponding findings in the existing literature can be challenging due to variations in empirical approaches and, often, a different set of climate disasters considered. For example, Klomp (2014) examined a set of emerging market economies and observed that geophysical and meteorological disasters diminish the distance-to-default metric for affected banks. Similarly, Albuquerque and Rajhi (2019) found that disasters may cause significant economic and financial disruption in low-income and middle-income countries. When examining the impact of natural disasters on banks in advanced economies, empirical assessments often yield milder or inconclusive results. The latter can be attributed to higher insurance penetration and possibly greater government support after disasters (see Noth and Schüwer 2018; Blicke, Hamerling, and Morgan 2021; Barth, Sun, and Zhang 2019).

<sup>9</sup> Data include financial institutions in 13 MENA and CCA countries, namely Algeria, Armenia, Georgia, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Pakistan, Saudi Arabia, Tajikistan, United Arab Emirates, and Uzbekistan.

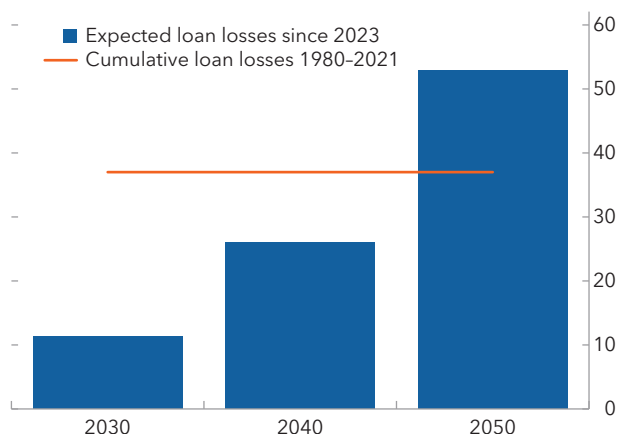
<sup>10</sup> As of the end of 2022, on average, bank Tier 1 capital to risk-weighted assets spanned from around 15 percent to over 25 percent.

**Figure 6. Future Physical Risks for the ME&CA Banks****1. Historical Patterns and Simulation Assumptions**

Historical patterns	
Average disaster incidence (1980-2020)	11%
Bank credit loss provision in disaster year (1980-2020 average)	\$250 million
Simulation assumptions	
Growth rate of disaster incidence (year-over-year)	0.2pp
Growth rate of disaster damage (year-over-year)	1.6%

Source: IMF staff calculations.

Note: ME&CA = Middle East and Central Asia.

**2. Estimated Cumulative Provision for Credit Losses, All ME&CA Banks (Billions of US dollars)****Estimating Future Costs of Physical Risks for ME&CA Banks**

With the projected intensification of climate disasters, the potential loan losses resulting from future climate shocks are expected to increase. By extrapolating historical trends in disaster frequency and the associated damage based on historical patterns, our analysis indicates that<sup>11</sup>:

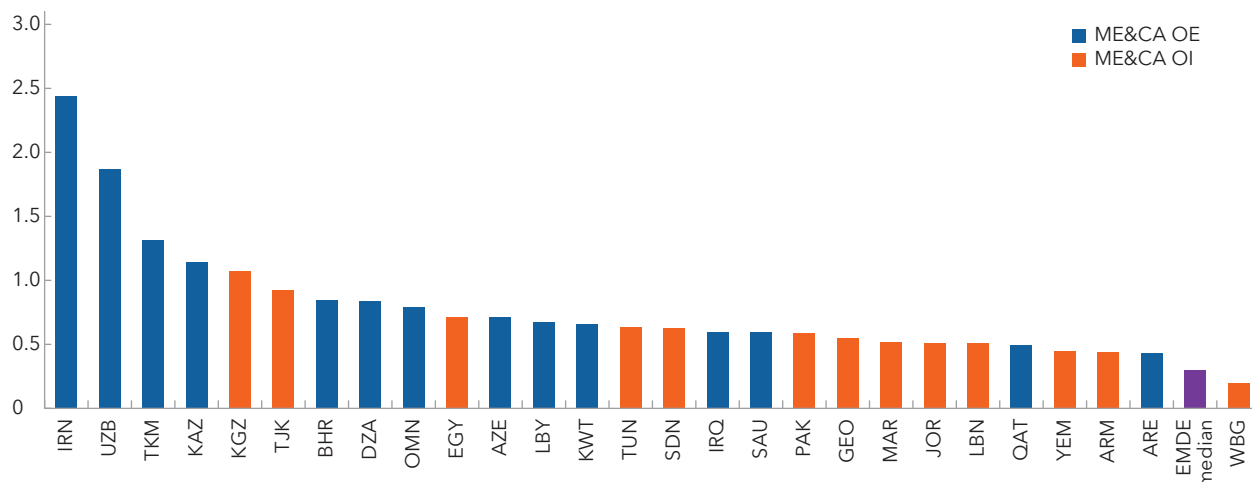
- *Frequency and impact of climate disasters:* Between 1980 and 2021, the relative frequency of disaster years for countries in the ME&CA region averaged around 11 percent (approximately 1 in 10 years). However, the probability of droughts and extreme temperature-related disasters has shown an upward trend, increasing by an average of 0.2 percentage point per year. As of 2022, this probability has reached 16 percent, while the average damage associated with disasters globally has risen at about 1.6 percent per year in real terms.
- *Potential loan losses:* Should these trends continue, cumulative loan losses that the banking sector of 30 ME&CA countries could face are projected to reach \$11 billion by 2030 and more than \$50 billion by 2050, in real terms. The latter figure corresponds to around 1-1.5 percent of total bank assets recorded in 2021. These results suggest that the projected cumulative bank losses over the next 27 years (up to 2050) are anticipated to surpass the cumulative losses incurred over the past 40-year period, that is, from 1980 to 2020 (Figure 6).

**C. Impact from Transition Risks on Banks in the ME&CA Region****Key Transition Risks in the ME&CA Region**

Climate transition may pose systemic risks to the financial sectors of the ME&CA region. In general, transition risks relate to changes in technologies, policies, and consumer preferences both at the regional and global levels, while changes in fossil fuel production and trade will have broader implications for public

<sup>11</sup> Using such an approach might result in underestimating the actual impacts of climate change on both the economy and banks, especially if the increase in disaster frequency and damage in the coming decades surpasses those of previous decades.

**Figure 7. ME&CA Emissions per GDP, 2019**  
(Kilograms of carbon dioxide equivalent, per \$GDP)



Sources: International Energy Agency; and IMF staff calculations.

Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. EMDE = emerging market and developing economy; ME&CA = Middle East and Central Asia; OE = oil exporter; OI = oil importer.

and private sector investment decisions, asset allocations, and revenue sources, among others. Within this context, two key sources of transition risks for ME&CA financial systems stem from increased emissions costs and the potential for stranded assets.<sup>12</sup>

### The Impact from Increased Emission Costs on ME&CA Banks

While the region's per capita emissions may not be among the highest globally, its economic activity demonstrates a relatively high emissions intensity (Figure 7).<sup>13</sup> In comparison to other emerging market and developing economies, the ME&CA region has a higher level of emissions per unit of output. This is particularly evident for oil-exporting countries, where the presence of hydrocarbon-related industries contributes to their emissions intensity, surpassing the emerging market and developing economy average. Conversely, oil-importing countries tend to exhibit emissions intensity levels more similar to those in other emerging market and developing economies. The strong association between economic activity and emissions in the region implies that costs of decoupling during the transition period could be substantial, potentially affecting financial stability, including through knock-on effects.

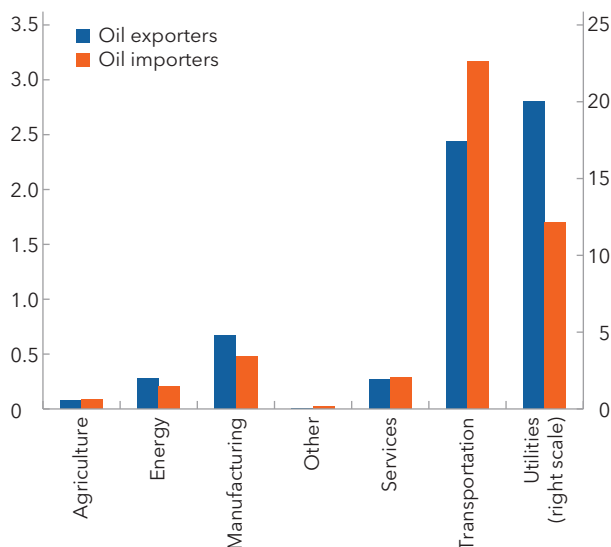
Within the region, the sectors of utilities, transportation, and manufacturing contribute the most to GHG emissions. This reflects high emission intensities, a strong reliance on hydrocarbons, and their significant contribution to GDP (Figure 8). Among oil-exporting countries, the utilities and manufacturing sectors display higher emissions intensity, while the transportation sector is more emission intensive among oil importers. Consequently, financial sector susceptibility to transition risks is influenced by their exposure to these economic sectors, along with the availability and cost of technological decarbonization solutions within these sectors and their integration into the wider economy and global supply chains.

<sup>12</sup> Bank exposures through trade finance is also substantial in some ME&CA countries, as is bank financing of fossil fuel investments. The latter may lead to the risk of holding large portfolios of stranded assets, which would become unproductive long before their anticipated "lifespan."

<sup>13</sup> The ME&CA region contributes to about only 10 percent of global greenhouse gas emissions, but the region is home to three of the world's largest emitters (that is, Iran, Pakistan, and Saudi Arabia), with four other countries in the region remaining among the largest global emitters per capita (Bahrain, Kuwait, Qatar, United Arab Emirates). See more in Duenwald and others 2022.



**Figure 8. ME&CA Sectoral Emission Intensity, 2019**  
(Kilograms of carbon dioxide equivalent per \$GDP)



Sources: International Energy Agency; and IMF staff calculations.

Note: *Energy*: petroleum, natural gas and coal, chemical industries; *Manufacturing*: durable and nondurable goods production, medical, business, automobile, textile, pharmaceutical, electrical equipment industries, construction sector; *Services*: personal and business services, restaurants, health and information technology sector, trade; *Utilities*: telecommunication sector, water and energy supply, natural gas transmission and distribution; *Other*: international affairs, foreign government. ME&CA = Middle East and Central Asia.

Meanwhile, firms have varying degrees of financial buffers to accommodate transition challenges. Firms in oil-exporting countries tend to exhibit stronger financial positions compared to those in oil-importing countries (as proxied by higher interest coverage ratios [ICRs]), while, from a sectoral perspective, firms operating in the services, transportation, and utilities sectors generally have lower ICRs (before accounting for the rising cost of carbon emissions)<sup>14</sup> compared to other sectors. Utility companies in the region are frequently state-owned enterprises (SOEs) that benefit from government subsidies. This limits the impact on the banking sector through the banks' loan exposures to such companies. Simultaneously, the transportation, utilities, and, to some extent, manufacturing sectors demonstrate the highest emissions intensity, whereas the services are relatively less intensive.

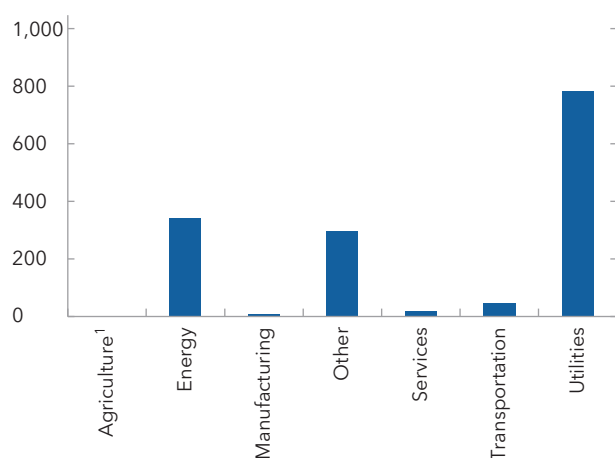
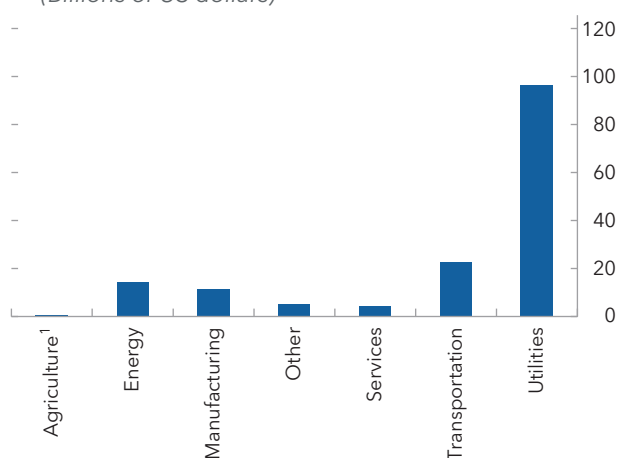
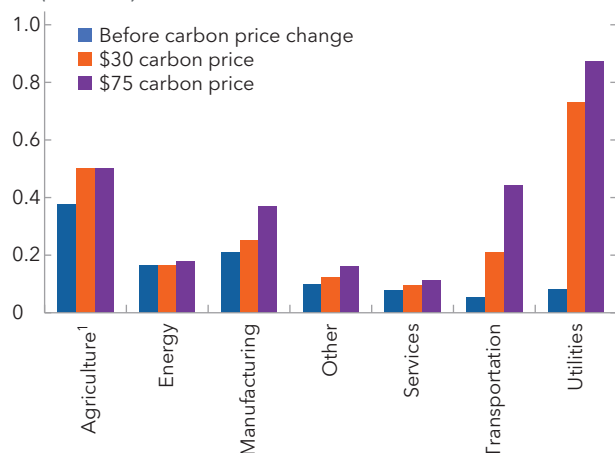
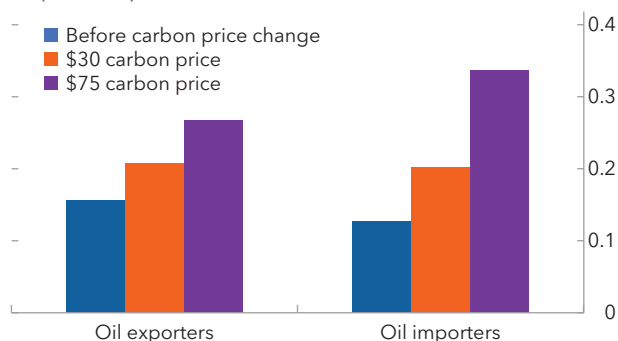
Consequently, firms operating in the manufacturing, transportation, and utilities sectors confront the highest risk of financial distress from a surge in emissions costs. For analytical purposes, an increase in emission costs can be implemented in various ways, including through a higher carbon price, a phasing out of energy subsidies, stricter regulations and standards,

and renewable energy incentives, among others (see "Policy Considerations"). However, in this paper, a carbon tax is used as a proxy policy change to estimate the potential impact on banks in the region.<sup>15</sup> By considering an (unweighted) share of companies and applying a carbon tax of \$75/ton of carbon dioxide and \$30/ton of carbon dioxide in two separate scenarios,<sup>16</sup> we calculate the additional burden on firms' operating expenses. In both scenarios, a high number of firms in the utilities and transportation sectors would be unable to cover their interest expenses, causing the ICR to fall below one, indicating that earnings would be insufficient to service outstanding debt obligations. In contrast, the energy sector experiences a smaller impact owing to its relatively modest carbon intensity and high profitability (see Figure 9 and Annex 2 on methodology).

<sup>14</sup> That is, before applying the stress test.

<sup>15</sup> Carbon border adjustments are also a significant and rapid policy-induced risk for the region, as those would effectively collect a carbon tax from the commodities produced using emission-intensive technologies. Hence, countries in the region would be limited in using their abundant fossil fuel resources to lower the energy costs of heavy manufacturing and produce cheaper and emission-intensive goods to export to the rest of the world.

<sup>16</sup> Assuming an average carbon price increase to \$75/ton of carbon dioxide equivalent aligns with the proposal for an international carbon price floor required by 2030 to limit global warming below 2 degrees Celsius, as supported by IMF (2019a). This would, however, entail a strong demand shock that is unlikely to happen as a one-time shock but rather a gradual move. The second scenario of \$30/ton of carbon dioxide equivalent is based on the necessary increase in the effective carbon rate in ME&CA to meet the countries' announced nationally determined contribution, bringing it closer to a probable scenario for ME&CA including as this would also start from a currently low base of estimated current carbon prices in the region (see Annex 2 for details). This calculation utilizes the findings of Anderson and others (2022), who estimate the current effective carbon rate level in ME&CA as the net fiscal revenue from domestic fossil fuel consumption (including taxation, emission permits, and subsidies) per metric ton of carbon dioxide emissions.

**Figure 9. ME&CA Firm-Level Stress Test****1. Number of Firms by Sector****2. Average Sales of Firms by Sector**  
(Billions of US dollars)**3. Share of Firms with ICR Below 1 by Industry**  
(Percent)**4. Share of Firms with ICR Below 1 by Group**  
(Percent)

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

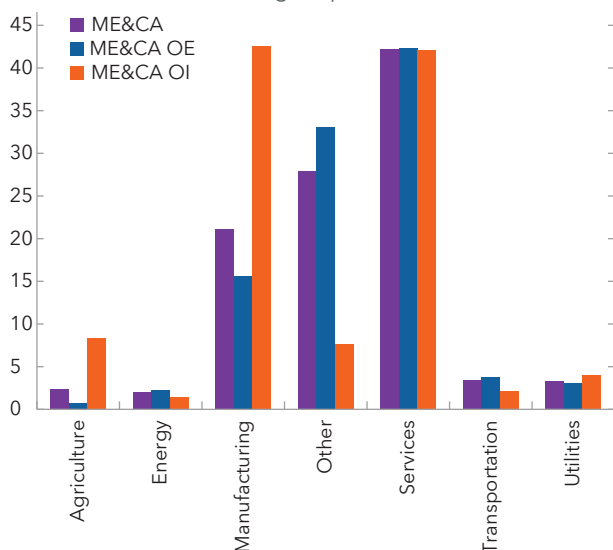
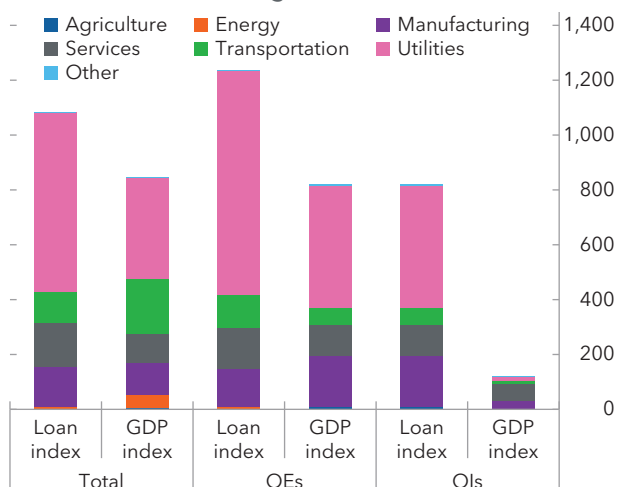
Note: ICR = interest coverage ratio; ME&CA = Middle East and Central Asia.

<sup>1</sup>Agriculture sector results are based on 2018 firm-level data due to lack of samples in the latest data set.

Considering bank loan portfolios in the region, they are found to be even more carbon-intensive than economic activity, further exacerbating the transition risks to the financial sector. In particular, energy-intensive sectors command a higher share in loan portfolios relative to their share in GDP, thus intensifying bank exposures to transition risks, particularly in oil exporters (Figure 10). Furthermore, banks' sovereign exposures, where these exposures are significant, could prove to be another source of transition risk to banks, which is not captured in this analysis.

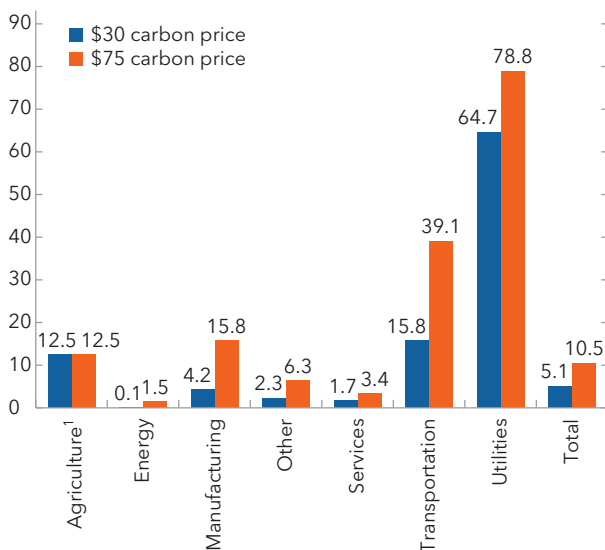
Drawing on the scenario where carbon costs increase to \$75/ton, we find that approximately 10.5 percent of loans in 18 ME&CA countries could be at risk of becoming nonperforming, representing a total value of \$139 billion (or 10.5 percent of total loans).<sup>17</sup> This risk is primarily driven by the high emissions intensity sectors such as utilities, transportation, and manufacturing, and the current low carbon prices in the

<sup>17</sup> Nonperforming loan estimates are not anchored in a specific time horizon given the potential for a "climate Minsky moment" where the impact of future transition risks on firms and banks could materialize sooner as rational forward-looking markets increasingly price in the risk.

**Figure 10. ME&CA Banking Sector Stress Test****1. Sectoral Banking Loans, 2021***(Percent of outstanding corporate loans)***2. Emission Intensity of GDP and Banking Systems' Loan Books in the Region, 2021<sup>1</sup>**

Sources: Haver Analytics; and IMF staff calculations.

Note: ME&amp;CA = Middle East and Central Asia; OE = oil exporter; OI = oil importer.

<sup>1</sup>Higher index means higher emissions intensity of GDP components or banking sector loan portfolio.**Figure 11. Share of Loans at Risk***(Percentage of outstanding loans)*

Source: IMF staff calculations.

<sup>1</sup>Agriculture sector results are based on 2018 firm-level data due to lack of samples in the latest data set.

region. This underscores the significant rise in loans-at-risk despite firms' relatively strong starting position.<sup>18,19</sup> However, under a \$30/ton scenario, which aligns with the unconditional commitments outlined in countries' nationally determined contributions (NDCs), the overall loans-at-risk reduces to around 5.1 percent of the total loans (Figure 11). Notably, the manufacturing sector experiences a substantial drop in loans-at-risk to 4 percent of the total loans (down from 16 percent under the \$75/ton scenario). This indicates that firms' balance sheets are better equipped to withstand an increase in emissions costs of this scale. It is worth noting that the increased risk for the banking sector stems not so much from the exposure of firms to the fossil fuel industry as such, but rather from many industries and firms heavily dependent on cheap energy and fuel subsidies provided by governments in the region.

<sup>18</sup> The scenarios assume, for the sake of simplicity, that the higher emission costs for some industries are not transferred to final consumers (see Annex 2 for further details). Should these costs be partially or entirely passed on to final prices, it could hurt economic growth and subsequently the banking sector. In the case of some oil-exporting countries within the region, oil prices may remain relatively high for a period, given current energy security risks, resulting in oil income potentially "recycled" in the economy to temporarily limit these adverse effects on both growth and the banking sector.

<sup>19</sup> Loans-at-risk pertain to loans extended to borrowers with an ICR < 1. A negative ICR position, known as a "firm-at-risk," suggests that the firms' current earnings are inadequate to service its outstanding debt obligations (earnings before interest and taxes/interest expense).

## The Impact from Stranded Assets

As in other regions, stranded assets in ME&CA countries are a growing concern as the world shifts toward renewable energy sources. These assets, which are primary fossil fuel reserves, may become uneconomical to extract, sell, and trade as global climate transition efforts advance. The broader factors contributing to the stranding of fossil fuel assets include changing demand favoring renewable energy due to its lower costs, regulations imposing limits on fossil fuel usage (like carbon pricing), and legal actions against high-emission firms.<sup>20</sup> In smaller open economies, the phenomenon may primarily reflect global decarbonization policies, rather than domestic initiatives.

The ME&CA region is home to some of the world's largest oil and gas reserves. The region's total productive capacity accounts for approximately 55 percent of global oil (equivalent to 911.7 billion barrels) and 52 percent of global gas (equivalent to 597.5 million barrel of oil equivalent). To contain global warming to the 1.5 degrees Celsius target set by the Paris Agreement, it is expected that around 60 percent of oil and gas as well as 90 percent of coal reserves should remain unextracted.<sup>21</sup> Consequently, these reserves risk becoming stranded, resulting in unutilized fossil fuel deposits and obsolete infrastructure, such as pipelines and power plants, among others.

However, stranded assets are not limited to just fossil fuels. They also extend to industries that rely on these fuels for production or utilize energy-intensive processes. A sudden repricing of the market value of firms in these sectors (triggered by an abrupt repricing of collateral value) can lead to financial losses, affecting not only these sectors but also their creditors and investors.<sup>22</sup> The loss of value will directly impact shareholders, investors, and investment funds, but would also affect banks that have lent to these firms or have other direct exposures.

Banks' exposure to fossil fuel assets are sizable in some countries in the region. For example, oil or gas extraction sectors are expected to hold most of the possible stranded assets in some countries (Kuwait, Saudi Arabia, Turkmenistan), but in others the burden will fall on the financial institutions (both banks and insurance companies) that finance and invest in these sectors (Kazakhstan). Some estimates and scenarios indicate that commercial banks (Kazakhstan) or creditors (Qatar) will suffer the most as a result of the transition to a low-carbon economy, given their current direct exposures. In those countries, for which data are available, governments are the largest owners of current assets, and for banks this would predominantly manifest in the form of credit risk associated with their exposure to government (through potential changes in sovereign ratings and corresponding credit spreads) (Figures 12-15).

However, assessing the potential impact of stranded assets is highly uncertain due to the unclear path toward low-carbon economies, the varying exposures of financial institutions across countries, and still considerable data limitations. The economic repercussions of stranded assets could reach into the trillions of US dollars, but estimating exact losses is challenging due to uncertainties surrounding future transition scenarios and

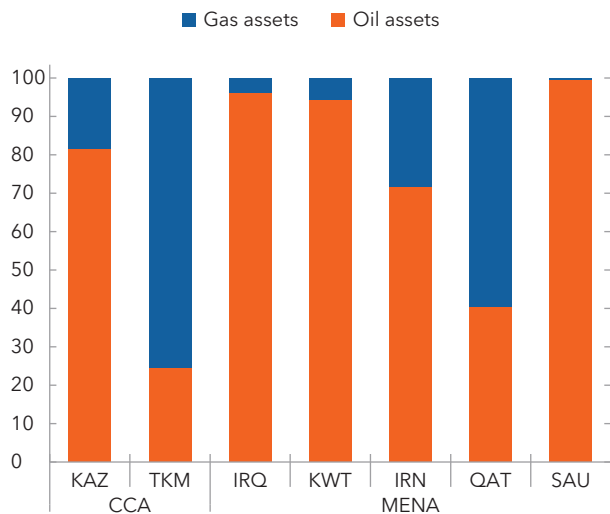
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<sup>20</sup> For GCC countries, this significant risk could be mitigated due to their low extraction and production costs, and abundant fossil fuel reserves. The cost efficiency results from factors like the proximity of reserves to the surface, efficient drilling and production technologies, and well-established infrastructure. This economic advantage enables GCC countries to maintain competitiveness in the global energy market, even as shifts toward renewable energy occur. Energy security considerations could reinforce this advantage, at least for a few years. Producers in the region also emphasize the potential use of oil/gas reserves for producing hydrogen and other clean energy sources. Although active exploration is under way, uncertainties persist regarding prospects, largely driven by technological and cost-related factors. While GCC countries may be somewhat insulated from immediate risks of stranded assets, the broader worldwide trend toward decarbonization and the push for renewable energy adoption still holds implications for their long-term energy strategies.

<sup>21</sup> This would translate into 547.0 billion barrels of oil and 358.5 million barrels of oil equivalent of gas being unproductive in the region.

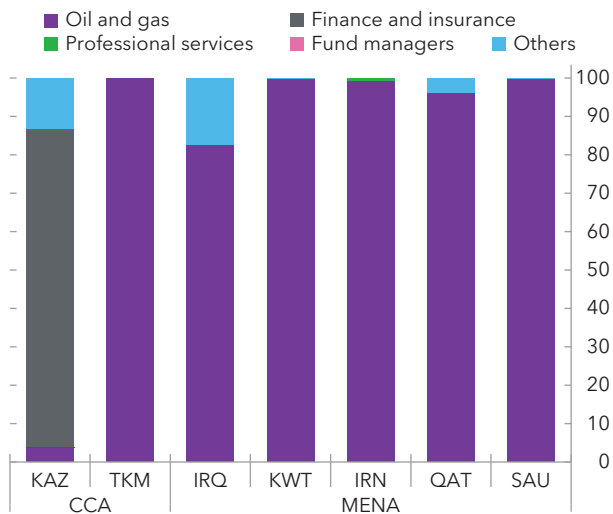
<sup>22</sup> The sudden repricing might also adversely affect banks' exposures to sovereign or quasi-sovereign assets, potentially leading to downgrades or defaults if the government's ability to meet its liabilities is compromised by stranded hydrocarbon assets.

**Figure 12. Stranded Assets by Type of Fossil Fuel**  
(Percent of total stranded assets)



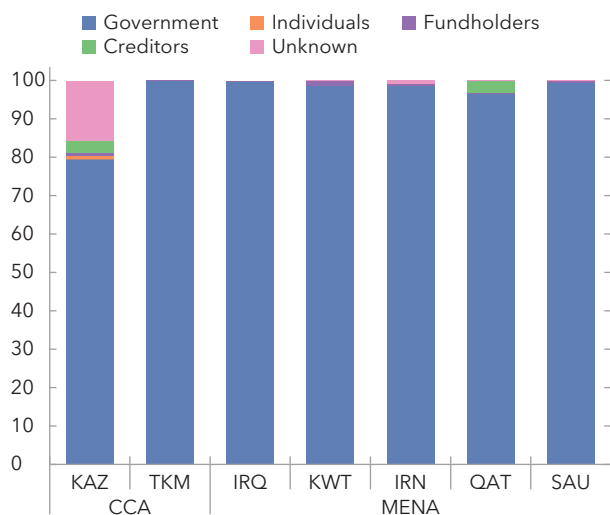
Sources: Semieniuk and others (2022); and IMF staff calculations. Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; MENA = Middle East and North Africa.

**Figure 13. Stranded Assets by Sector**  
(Percent of total stranded assets)



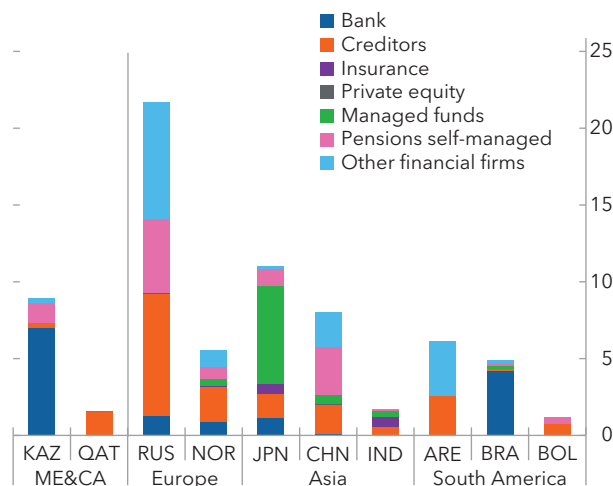
Sources: Semieniuk and others (2022); and IMF staff calculations. Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; MENA = Middle East and North Africa.

**Figure 14. Stranded Assets by Type of Ownership**  
(Percent of total stranded assets)



Sources: Semieniuk and others (2022); and IMF staff calculations. Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; MENA = Middle East and North Africa.

**Figure 15. Cumulative Losses Mediated through the Financial Sector**  
(Billions of US dollars)



Sources: Semieniuk and others (2022); and IMF staff calculations. Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. CCA = Caucasus and Central Asia; ME&CA = Middle East and Central Asia; MENA = Middle East and North Africa.

their impact on asset valuations.<sup>23,24</sup> Some fossil fuel companies (including those in the ME&CA region) are diversifying into renewable energy, which can help mitigate transition risks. However, such an analysis is highly uncertain, given the lack of reliable information that can be extracted from mandatory disclosure sources. Challenges arise not only from the lack of data but also from assessment methods, making it difficult to accurately monitor banks' exposures to stranded assets.

## D. Climate Risks and the ME&CA Insurance Sector

The insurance sector has a special role to play in addressing climate risks. It can mitigate the effects of climate-related events by providing financial protection against the adverse impacts of climate disasters and assist economic agents to recover from climate losses and damages. However, the sector itself is vulnerable to climate risks through physical, transition, and liability risks which may affect the demand for insurance services as well as the supply of future insurance offerings. This may especially be the case, given the changing nature of risks which may affect the insurability of certain sectors. It includes situations where frequent extreme climate hazards are prevalent, prompting questions on how governments can support developing the insurance sector under these circumstances. For example, in some advanced economies, insurance firms are no longer covering areas that are frequently hit by hurricanes, wildfires, or prone to flooding. While all these risks can have serious consequences for the insurance sector, in most ME&CA countries, the scale and penetration of insurers remain rather small (see Annex 3). This limited presence reduces its capacity to act as an effective buffer against climate risks, leading to climate-related losses and recovery costs being passed on to both ME&CA governments and other economic agents.

The transmission of climate change risks to the insurance sector and the economy can propagate both directly and indirectly. Direct channels could manifest through high insured losses, which eventually affects insurance coverage and premiums, collateral values, and overall weakness in both households and firm balance sheets. Indirect channels can propagate through uninsured losses—which may affect the resource availability, the profitability of firms, and the valuation of individual assets—economic disruptions, and ultimately impact the demand and supply dynamics within insurance market (IAIS 2018). Besides, uninsured losses may have cascading impacts throughout the financial system, including on investment companies and banks, ultimately impacting the entire economy (Figure 16).

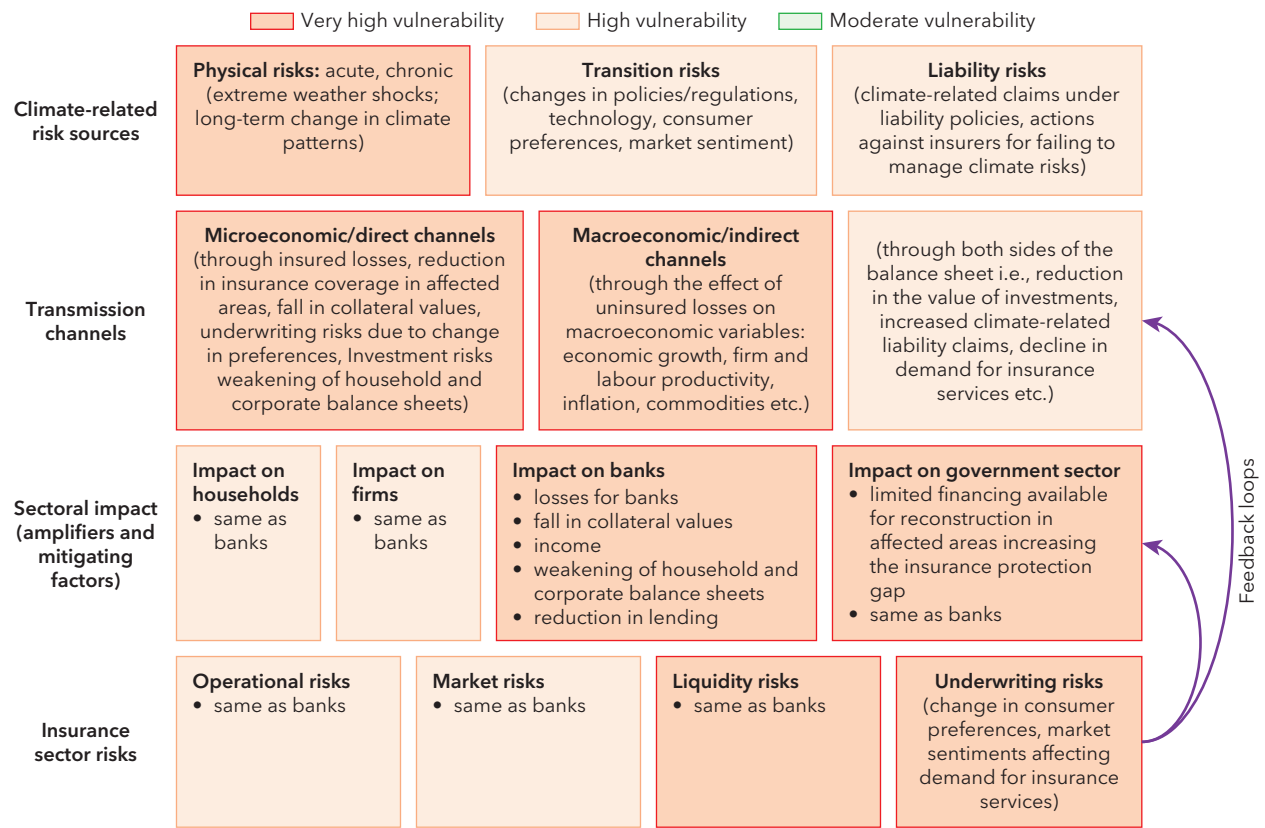
### The Impacts of Climate Change-Related Risks on the ME&CA Insurance Sector

Physical risks in the ME&CA region can lead to large insured and uninsured losses. Increases in risk profiles of insured assets and property due to physical risks may lead to an increase in claims on insured property, which eventually results into high insured losses. At the same time, the possibility of uninsurability of property arising from physical risks may lead to an elevation of uninsured losses with significant negative implications on available government resources, economic growth, and demand for insurance services. Within the region, insurance resilience to climate-related disasters remains very low compared to other regions, mainly due to low insurance coverage. Between 2005 and 2019, the insurance resilience index for the region averaged about 4 compared to an average of about 33 for advanced economies, implying low resilience of the insurance sector to effectively withstand the impacts of natural catastrophes (Figure 17). During the same period, only 16 percent of the region's insurance protection needs were met, resulting in significant economic losses (Figure 18). Estimations suggest that climate-related disasters caused \$44 billion in economic losses (about 2 percent of GDP) from 2003 and 2019, of which only \$2 billion was covered by insurance. The burden of these losses was borne primarily by the public sector, which increased its financing needs, including from banks, and affected the demand for insurance services.

<sup>23</sup> For example, Semieniuk and others (2022) calculated that global stranded assets as the present value of future lost profits in the oil and gas sector exceed \$1 trillion with likely changes in expectations regarding the effects of climate policy.

<sup>24</sup> Other studies have tried to estimate risks outside the fossil fuel industry, for example in construction and industrial sectors.

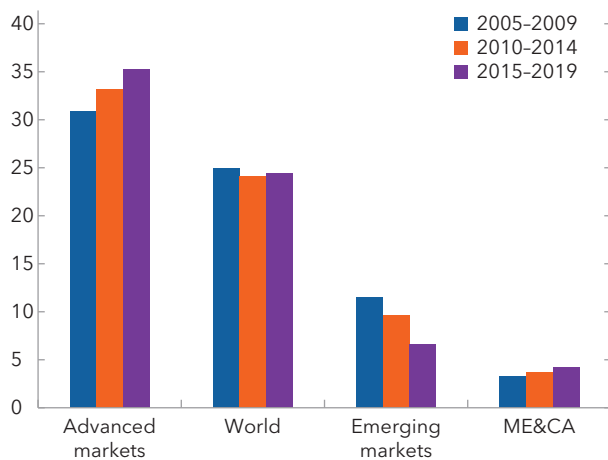
**Figure 16. Climate Risks and Transmission Channels to the Insurance Sector in the ME&CA Region**



Sources: IAIS (2018); and IMF staff.

Note: This is a relative assessment and not a quantification of risk. ME&CA = Middle East and Central Asia.

**Figure 17. Insurance Resilience Index against Natural Catastrophes<sup>1</sup>**

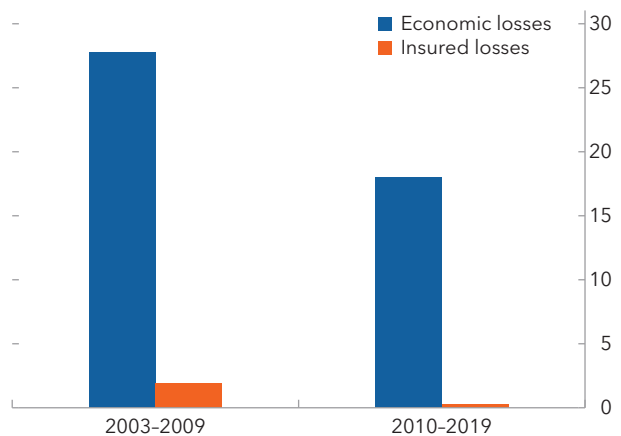


Sources: Swiss Re (2022); and IMF staff estimates.

Note: ME&CA = Middle East and Central Asia.

<sup>1</sup>The insurance resilience index ranges from 0: no resilience to 100: fully protected.

**Figure 18. Economic Losses and Insured Losses due to Natural Catastrophes in ME&CA (Billions of dollars)**



Sources: Swiss Re (2021); and IMF staff estimates.

Note: ME&CA = Middle East and Central Asia.

Transition risks in the ME&CA insurance sector relate to inadequate valuation of climate risks, undisclosed exposures to stranded assets, and shifts in demand for insurance products and services. With over 58 percent of insurers' investments in bonds and equity in the GCC region, the materialization of repricing could give rise to significant losses over time. The growth in renewable energy and the changing market dynamics may result in stranded assets, potentially leading to financial and credit market losses. The commitment to global climate targets under the 21st Conference of the Parties agreement could impact insurers' assets, liabilities, and the viability of specific business lines—requiring new techniques for portfolio management. This would pose challenges in managing climate-related risks and large renewable assets in the region's traditionally focused insurance market, which predominantly encompasses health, motor, and property coverage.

Liability risks include the risk of climate-related claims under existing liability policies, as well as direct claims against insurers for failing to manage climate risks. These could arise from insufficient disclosure of present and future risks related to climate change by company executives, resulting in increased claims. Growing public awareness and pressure to hold managements accountable for inaction in climate mitigation and adaptation further contribute to these risks. While still evolving, this risk could potentially lead to substantial losses for insurance companies in terms of payouts and damages. Additionally, liability risks may include exposure to third-party environmental liability policies covering property losses and pollution-related liabilities. Reputational risks are also a concern, as changing public perceptions and the increasing number of lawsuits against carbon-intensive firms may lead to negative publicity (IAIS 2018).

### The Role of Reinsurance in the ME&CA Region

Reinsurance plays a limited but crucial role in the ME&CA region by providing risk transfer, thus supporting financial stability of primary insurers. Due to increasing exposure to various risks in the region, reinsurance acts as a vital backstop for primary insurers, assisting them in managing climate-related risks by sharing the burden of large and complex claims, ensuring that the insurance industry remains resilient and capable of meeting policyholders' needs. Indeed, the region's reliance on reinsurance is growing and presents an opportunity for the primary insurance market to leverage the available reinsurance capacity to diversify its insurance portfolio, especially in high-value climate-related risks.



### 3. Green Transition: A Look at the Investment Needs in the ME&CA Region

As the ME&CA region is at a critical juncture in its quest for a green future, addressing urgent needs for climate change mitigation and adaptation will require significant investment in the ME&CA region. Alongside the imperative to reduce emissions and develop renewable energy sources, there is also a corresponding need for the region to build climate-resilient infrastructure, protect coastlines, and secure scarce water resources. Achieving a green future therefore requires not only a strategic reallocation of existing resources, but also a significant mobilization of new capital, without creating risks of unsustainable debt, especially in countries with limited fiscal space. This can be particularly challenging for fragile states and low-income countries in the region, where the estimated investment needs associated with climate adjustments are disproportionately high.

The scale of the investment needs associated with climate change mitigation and adaptation in the ME&CA region is immense. NDCs published by most (that is, 31 out of 32) ME&CA countries have identified a wide range of investment priorities to address the challenges from climate transition.<sup>25</sup> These include:

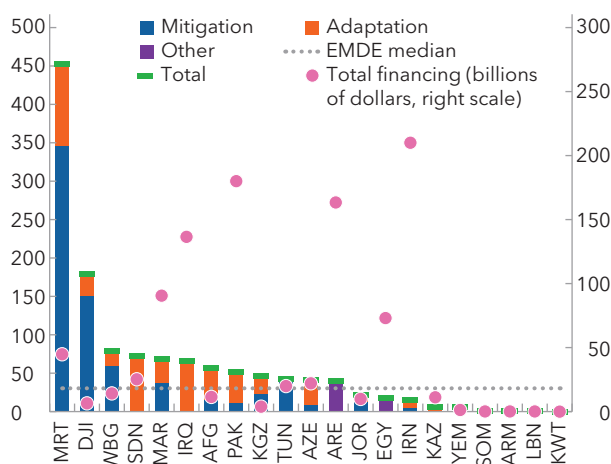
- *Mitigation actions to reduce emissions or increase absorption of GHGs.* These are estimated based on NDCs and include a wide range of investment priorities such as: afforestation/reforestation (Somalia, United Arab Emirates), renewable energy production from sources like solar power (Algeria, Pakistan), investment in technologies to reduce carbon dioxide emissions from the hydrocarbon extraction and mining (Morocco, Oman, United Arab Emirates), expansion of the public transport networks (Sudan), modernization of waste management (Tunisia), or carbon dioxide capture from the atmosphere (Saudi Arabia).<sup>26</sup>
- *Adaptation actions to reduce the risk of damage caused by climate change and build new climate-resilient infrastructure.* Most countries in the region emphasize the need to invest in water resource management, as the water stress associated with climate change is already hitting the region hard (World Bank 2018, World Resource Institute 2023). Other countries focus on protecting coastlines from rising sea levels (Tunisia), greening buildings (United Arab Emirates), building protective infrastructure against floods and mudslides (Turkmenistan), or modernizing farming (Georgia, Pakistan, Somalia, Sudan).

A total of 21 ME&CA countries require more than \$1 trillion for climate change-related financing, with significant variation across countries (Figures 19 and 20). So far, only 21 countries in the region have expressed their long-term financial needs, with some major economies yet to assess and publish them. In this group, which represents about 71 percent of the region's GDP, Egypt, Iran, Iraq, Morocco, Pakistan, and the United Arab Emirates account for most of the total expressed financial needs. The cumulative multiyear financing needs for these 21 countries represent on average about 60 percent of their GDP in 2021, with significant dispersion ranging from 1 percent of GDP or less for Armenia, Kuwait, Lebanon, and Somalia to as much as 178 percent for Djibouti and more than 450 percent for Mauritania. A large part of the expressed needs refers

<sup>25</sup> NDCs are action plans targeting GHG emission cuts and adaptation to climate change. The 2015 Paris Agreement requires an update to NDCs every five years, and the Glasgow Pact in 2021 called for a revision of all NDCs in 2022 to bring planned geographic emissions to levels that are more consistent with the goal of limiting global warming to 1.5 degrees Celsius.

<sup>26</sup> Governments invest in cutting emissions to meet their commitments under international agreements and take policy actions (such as regulation and taxation) that lead the private sector to internalize the social costs of GHG emissions and encourage private investment in climate mitigation projects. When it comes to adaptation, it can be undertaken both by public entities focusing on increasing the resilience of infrastructure to climate change, as well as by companies and individuals, who see to protect their productive assets or housing from climate hazards.

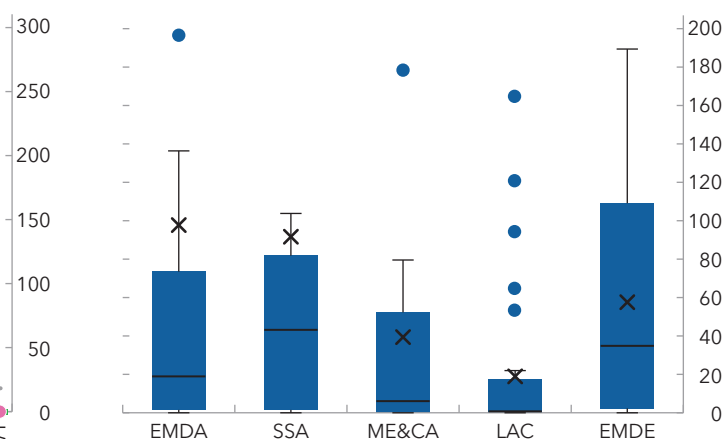
**Figure 19. ME&CA Financing Needs, Upper Range**  
(Percent of 2021 GDP, unless otherwise indicated)



Sources: UN Framework Convention on Climate Change; and IMF staff calculations.

Note: Lebanon's and Afghanistan's financing needs are in percent of 2020 GDP due to the unavailability of the 2021 GDP data. United Arab Emirates has a 2050 Energy Strategy that specifies an AED600 billion investment need for energy transition. Data labels in the figure use International Organization for Standardization (ISO) country codes. EMDE = emerging market and developing economy.

**Figure 20. Expressed Financing Needs, by Region**  
(Percent of 2021 GDP)



Sources: UN Framework Convention on Climate Change; and IMF staff calculations.

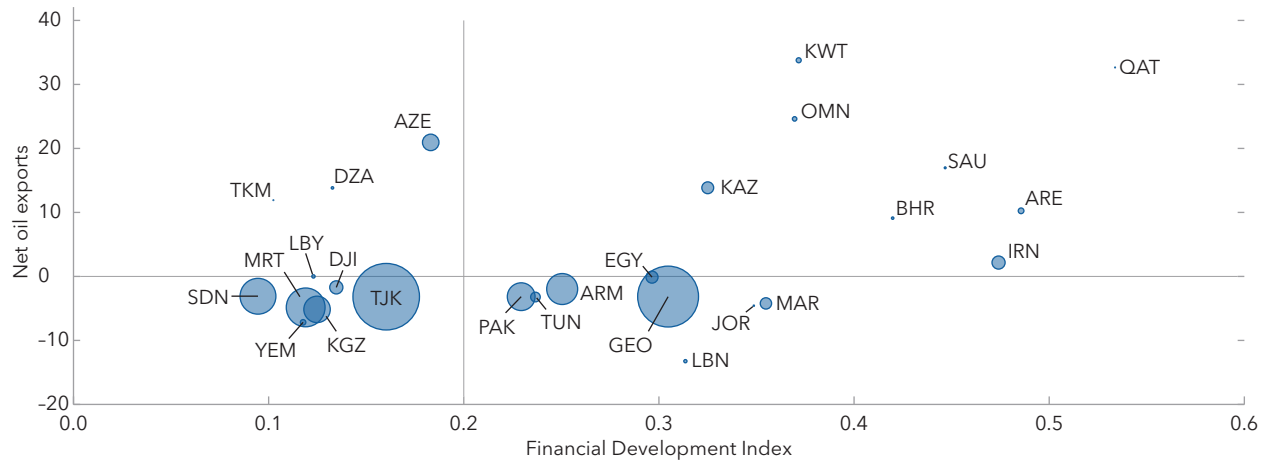
Note: Note: The rectangles represent the middle 50 percent of the distribution, the crosses represent the mean, and the dots are outliers. EMDA = emerging and developing Asia; EMDE = emerging and developing Europe; LAC = Latin America and the Caribbean; ME&CA = Middle East and Central Asia; SSA = sub-Saharan Africa.

to plans related to official foreign funding. For example, about 91 percent of the financing needs outlined in NDCs by 11 countries at the end of 2020 hinged on the expectation of international public financial support (ESCWA 2021).

Other estimates point to higher investment needs associated with climate change in the ME&CA region. To mitigate climate change, the Intergovernmental Panel on Climate Change (de Coninck and others 2018) estimated that containing the global temperature rise at 1.5 degrees Celsius would require an annual investment of \$2.4 trillion in the energy sector by 2035. Given the region's share of global GDP (12.9 percent in 2021) and global emissions (10.3 percent in 2020), this would translate into approximate annual investment needs ranging from \$250 to \$310 billion. In terms of adaptation, the required annual investment to strengthen the resilience of infrastructure in the region is estimated at around 1.6 percent of GDP per year or \$80 billion in 2021 (Aligishiev, Bellon, and Massetti 2022). This includes expenditure needs for storm and flood risk protection and the fortification of coastal areas against future sea level rise (all accounting for a substantial share of adaptation investment). These estimates suggested cumulative annual investment needs to address climate change of \$2,600 billion to \$3,100 billion (equivalent to 65 to 78 percent of the region's 2021 GDP) in the ME&CA region between 2023 and 2030.

However, some of the countries with proportionately the greatest financing needs, especially in terms of adaptation, are also the least prepared due to their weak financial development, limited fiscal space, and high debt burdens. In fact, the average annual cost of strengthening the resilience of infrastructure in low-income ME&CA countries at 3.2 percent of GDP is much higher in relative terms than the average cost of 0.6 percent of GDP for emerging markets in the region (Aligishiev, Bellon, and Massetti 2022). These estimates cover expenditure needs for storm and flood risk protection, in addition to safeguarding coastal areas from future sea level rise (all accounting for a substantial share of adaptation investment). For example, estimated annual investment needs for adaptation are comparatively high in the Kyrgyz Republic (1.3 percent of GDP), Mauritania (1.9 percent of GDP), Tajikistan (3.3 percent of GDP), and Sudan (1.8 percent of GDP), while these

**Figure 21. Country Classification Based on Resource Endowment and Financial Development**  
(Percent of GDP)

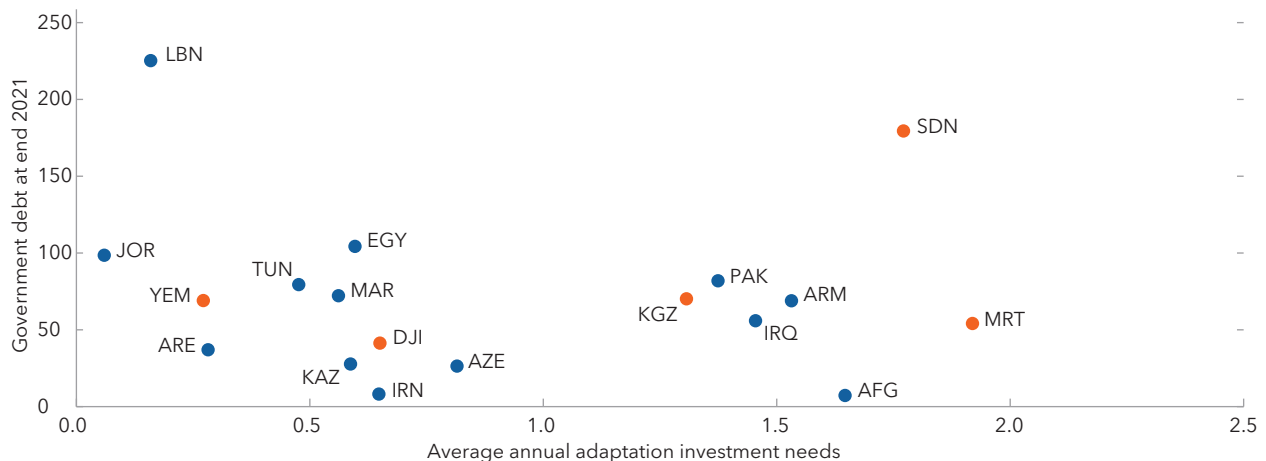


Sources: Aligishiev, Bellon, and Massetti (2022); Financial Development Index; and IMF, World Economic Outlook database.  
Note: Size of the bubbles represent the total public and private adaptation needs in percent of 2020 GDP, based on estimates by Aligishiev, Bellon, and Massetti (2022). Data labels in the figure use International Organization for Standardization (ISO) country codes.

countries rank within the lower global deciles in terms of their financial development, as measured by the Financial Development Index (Figure 21). Adaptation needs are also high in some countries with limited fiscal space such as Pakistan (1.4 percent of GDP) (Figure 22).

Substantial adaptation costs are also expected to fall on the private sector, given the scale of green investment needs.<sup>27</sup> The estimated adaptation costs to be borne by the private sector are substantial, although somewhat lower in the ME&CA region than in other parts of the world (Figure 23). Globally,

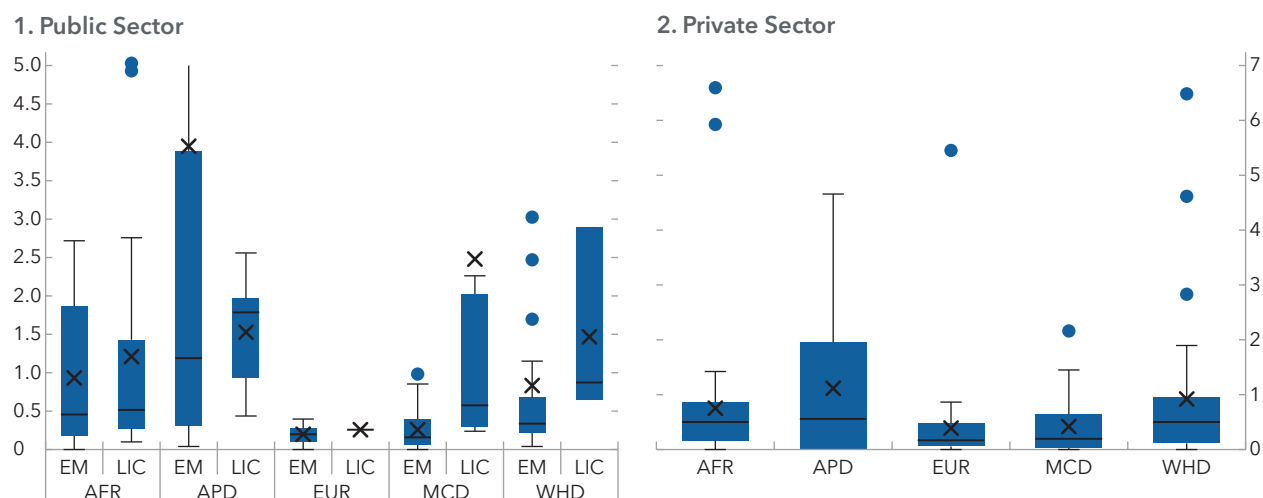
**Figure 22. ME&CA Financing Needs and Government Debt**  
(Percent of GDP)



Sources: Aligishiev, Bellon, and Massetti (2022); UN Framework Convention on Climate Change; and IMF staff calculations.  
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. ME&CA = Middle East and Central Asia.

<sup>27</sup> Governments invest in cutting emissions to meet their commitments under international agreements and take policy actions (such as regulation and taxation) that lead the private sector to internalize the social costs of GHG emissions and encourage private investment in climate mitigation projects. When it comes to adaptation, it can be undertaken both by public entities focusing on increasing the resilience of infrastructure to climate change, as well as by companies and individuals, who see to protect their productive assets or housing from climate hazards.

**Figure 23. Adaptation Costs to Selected Climate Risks**  
(Percent of 2019 GDP)



Sources: Aligishiev, Bellon, and Massetti (2022); and IMF staff calculations.

Note: The rectangles represent the middle 50 percent of the distribution, the crosses represent the mean, and the dots are outliers. AFR = African Department; APD = Asia-Pacific Department; EM = emerging markets; EUR = European Department; LIC = low-income countries; MCD = Middle East and Central Asia Department; WHD = Western Hemisphere Department.

four sectors—namely, agriculture, infrastructure, water, and disaster management and preparedness—are estimated to account for three-quarters of the adaptation financing needs (Rockefeller Foundation and BCG 2022). Annual investment needs for adaptation to enhance the resilience of private assets are estimated to average around 0.5 percent of GDP in ME&CA, which is lower than that of the Asia Pacific (1.5 percent), Western Hemisphere (1 percent), and sub-Saharan Africa (0.8 percent), and below the average for emerging market countries (1.3 percent) (Aligishiev, Bellon, and Massetti 2022). That said, the cost of protecting private infrastructure is higher than for the regional average in two emerging markets, that is, in Georgia (1.2 percent) and Armenia (0.8 percent).

Climate investment needs estimations remain subject to considerable uncertainty and should therefore be interpreted with caution. These estimates are constantly evolving as the understanding of future path of GHG emissions, their impact on average temperatures, the probability of extreme weather events, the associated financial needs, and their relative urgency continues to gradually improve. Moreover, countries will have to balance trade-offs between the extent to which energy prices are used as a tool to address mitigation needs and finance investments, and the scale of renewable investment needs. Overall, effective mitigation investments are expected to limit the scale of adaptation needs, while insufficient mitigation investment may increase the adaptation costs to very high levels (IPCC 2001). In addition, climate investment needs are highly sensitive to assumptions on technological breakthroughs, the carbon intensity of economic activity, long-term demographic growth, and population migration patterns. Data and capacity gaps at country levels further compound these complexities and impede the realism of these estimations.

Reallocating investment spending away from carbon-intensive sectors and activities in the region could help meet green investment needs, although is likely to remain insufficient given the required scale. In 2018 to 2022, the Middle East, excluding North Africa, has invested around \$611 billion in fossil fuels, versus only \$21 billion invested in renewables (IEA 2023). The investment in fossil fuels reflects both the dominance of hydrocarbons in these economies and their large hydrocarbon reserves. By comparison, the annual investment needs for clean energy alone, aligned with the goals set forth in the Paris Agreement, are estimated to reach around \$148 billion for the Middle East and North Africa (MENA) region alone (IRENA 2019). Increasing climate-related investments while gradually phasing out fossil fuel investments over time would not only

help to meet climate goals, but also promote economic diversification—a key objective of many countries in the region.<sup>28</sup> This approach would also foster innovation and productivity growth, generate jobs, and create new growth drivers, for example in renewable energies and battery metals, thereby boosting economic activity and government resources (Rozenberg and Fay 2019).<sup>29</sup> However, these gains are likely to show only over the medium to long term.

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<sup>28</sup> Green investment opportunities within the ME&CA region are also linked to the extraction and refining of “critical minerals” that are an important source of (actual or potential) exports, revenues, and jobs for the region. They play an important role in the manufacturing of renewable energy systems, electric vehicles, advanced electronics, and other environmentally friendly technologies. Several countries in the ME&CA region hold significant reserves of these minerals and notable examples include copper (found in Afghanistan, Iran, Kazakhstan, Oman, Pakistan, Saudi Arabia, and Uzbekistan), uranium (extracted from Iran, Kazakhstan, and Uzbekistan), as well as nickel and lithium (both present in Morocco).

<sup>29</sup> These green investment opportunities encompass not only the economic benefits of mineral extraction and processing but also the potential to drive innovation, create jobs, and contribute to the global transition toward sustainable technologies. It is important to note that responsible and sustainable extraction practices, along with effective environmental safeguards and social considerations, are essential to ensure that these opportunities align with long-term environmental objectives.

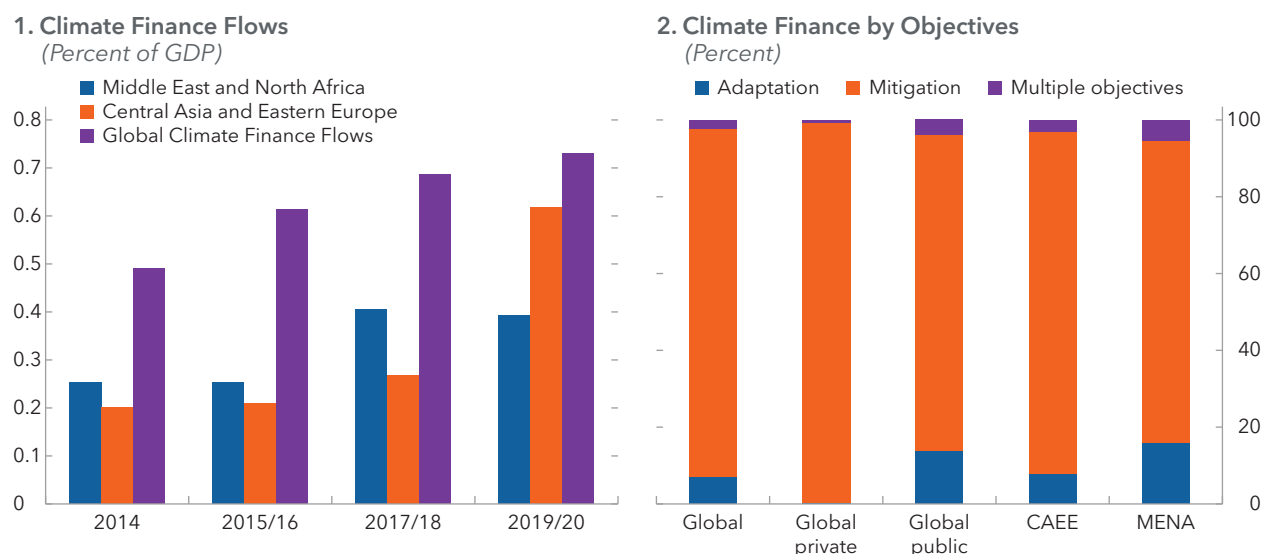
## 4. Opportunities in the Domestic Financial Sectors in the Transition to a Green Economy

As in other parts of the world, climate finance in the ME&CA region focuses primarily on climate mitigation, with limited resources allocated to adaptation needs. Bilateral and multilateral external sources provide the bulk of funding, which is predominantly debt-based, project-oriented, and non-concessional. The use of climate finance products, such as green bonds and loans, is still relatively limited, with only a few countries, mainly in the GCC, issuing them. Domestic lenders face wide-ranging barriers in scaling up financing for green projects. Banks have the potential to contribute more to the development of green finance and benefit from these opportunities, but for this to happen, an enabling environment needs to be created.

### A. Evolution of Climate Finance in the ME&CA Region

Climate finance in the ME&CA region has been growing, but still lags behind other regions and relative to expressed needs (Figure 24). In recent years, governments in ME&CA have announced net zero targets, while regulators have started to issue guidance on sustainable finance and required reporting. The region has seen a rise in government-led investments and public-private partnerships (PPPs) for green projects, investments in renewable energy, and sustainability-linked sovereign and corporate issuances, yet significant gaps remain. According to the Climate Policy Initiative (2021), annual climate finance flows in the Middle East and North Africa (MENA) countries averaged only 0.4 percent of GDP during 2019–20, which is approximately half of the global average of 0.7 percent during that period. And while flows into MENA have risen by 170 percent since 2014, reaching \$15 billion, they still fell far short of the required funding (see Chapter 3).

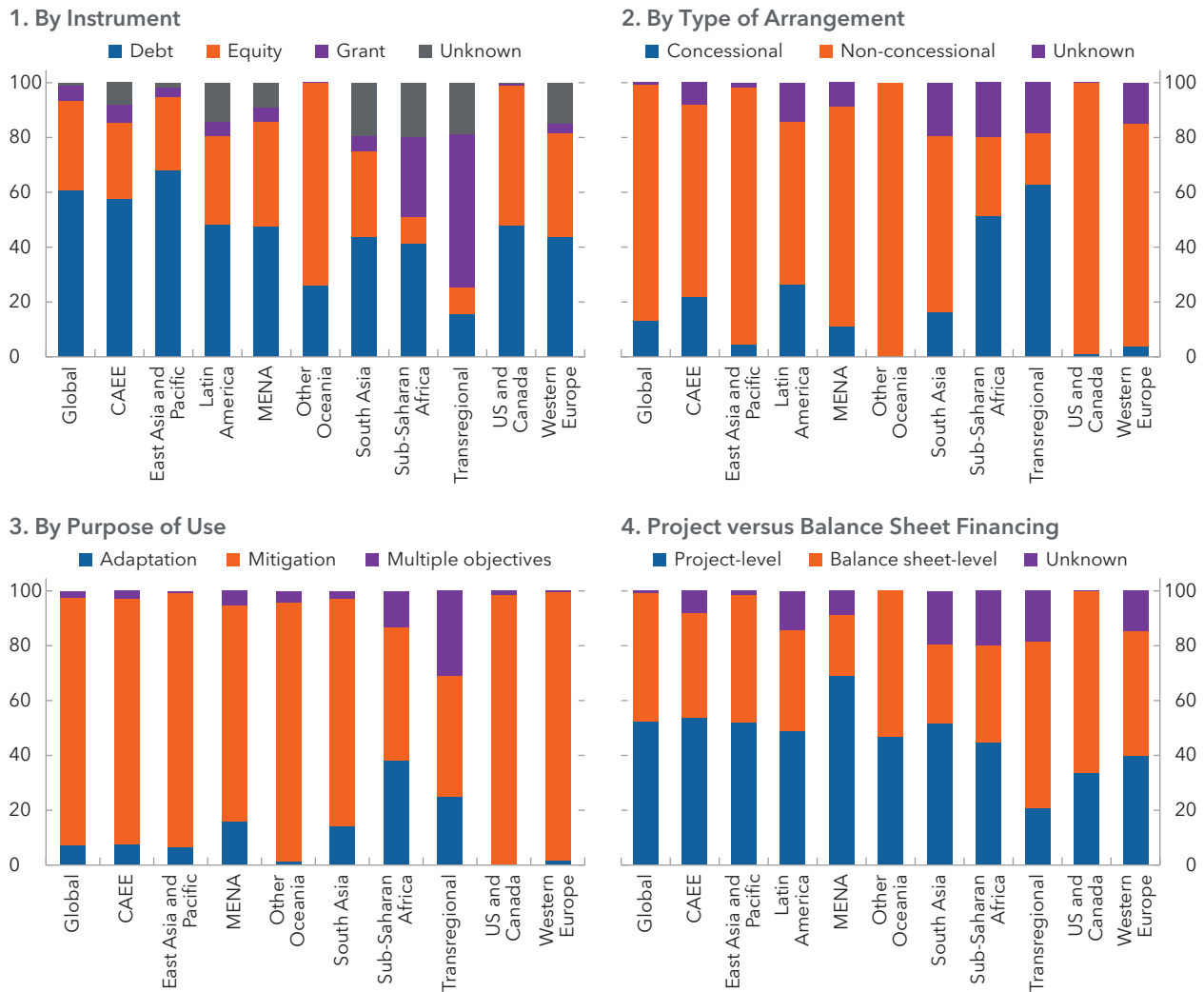
**Figure 24. Climate Finance Flows**



Sources: Climate Policy Initiative; and IMF staff calculations.

Note: CAEE = Central Asia and Eastern Europe; MENA = Middle East and North Africa.

**Figure 25. Climate Finance Composition, 2019/20**  
(Percent)



Sources: Climate Policy Initiative; and IMF staff calculations.

Note: CAEE = Central Asia and Eastern Europe; MENA = Middle East and North Africa.

The situation is similar in the CCA. The Intergovernmental Panel on Climate Change (2022) estimates that current mitigation flows, measured in 2015 US dollars, would need to increase 12 to 23 times in the ME&CA region to meet average mitigation needs through 2030.

The bulk of climate finance has been allocated to mitigation efforts, which is consistent with global trends. In the MENA region, climate mitigation receives an overwhelming share of climate finance inflows, similar to the CCA. This financing primarily supports the energy sector (29 percent), addressing the need for transition, followed by the water sector (15 percent) and transport and logistics (12 percent).

In line with global patterns, the majority of climate finance inflows are debt-based, non-concessional, and project-focused (Figure 25). Specifically:

- Bilateral and multilateral external financing plays a key role in climate finance (Box 3).
- Debt instruments represent the largest component of climate inflows in MENA (48 percent), followed by equity (38 percent).

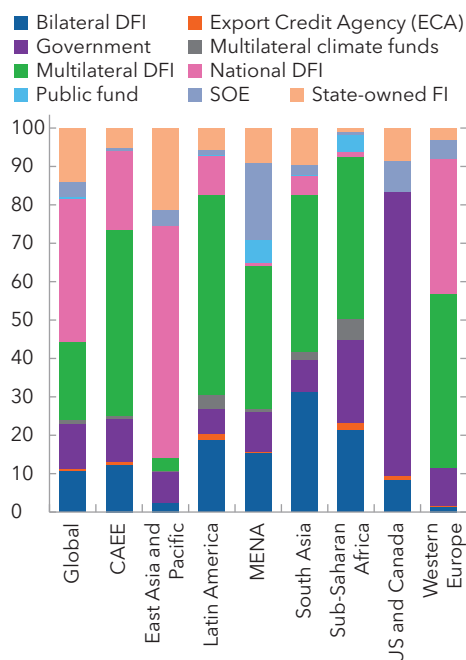
### Box 3. Public Green Financing Inflows to ME&CA (including Multilateral Development Banks)

Climate finance in the region tends to originate from the public sector:

- Public climate finance inflows accounted for 56 percent of inflows to the Middle East and North Africa (MENA) in 2019-20, versus a global average of 51 percent.
- Multilateral development financial institutions contributed more than a third of total climate related public finance in MENA, significantly above the global average.
- The share of bilateral development financial institutions in public financing is also significant with 16 percent in MENA.
- A fifth of public climate financing in MENA came from state-owned enterprises, reflecting their large footprint in the region’s economy and only 6 percent from funds (infrastructure and private equity). The contribution of national development financial institutions is limited in the region.

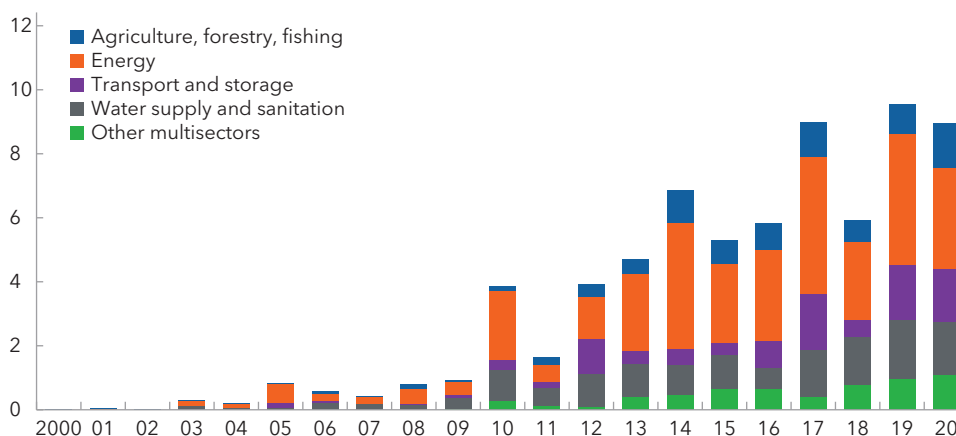
Although climate financing from bilateral and multilateral creditors has grown steadily in recent years, it remains insufficient to meet needs. Bilateral and multilateral climate-related development financing for Middle East and Central Asia countries has risen from less than \$1 billion prior to 2008 to \$12.1 billion in 2019, before declining slightly to \$11.8 billion in 2020 due to the COVID-19 pandemic.

**Box Figure 3.1. Composition of Public Climate Finance (Percent)**



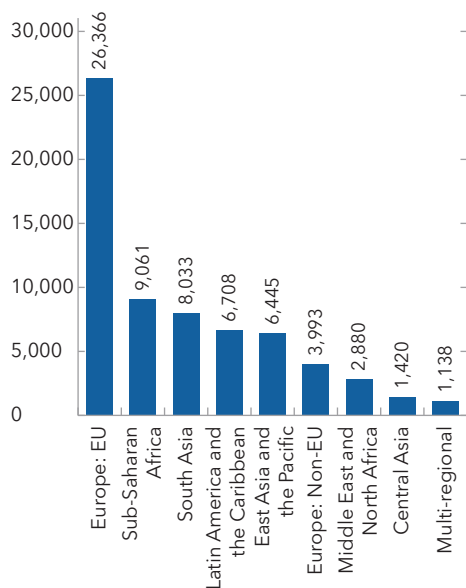
Sources: Climate Policy Initiative; and IMF staff calculations.  
 Note: CAEE = Central Asia and Eastern Europe; DFI = development financial institution; FI = financial institution; MENA = Middle East and North Africa; SOE = state-owned enterprise.

**Box Figure 3.2. Middle East and Central Asia Received Official Climate Financing, by Sector (Billions of US dollars)**



Sources: Climate Change: OECD DAC External Development Finance Statistics; and IMF staff calculations.



**Box 3. (continued)****Box Figure 3.3. MDB Financing by Region in 2020***(Millions of US dollars)*

Source: EBRD (2021).

Note: EU = European Union; MDB = multilateral bank.

Climate investments needs in the region are being met through several funds, as summarized in Box Table 3.1. Other key players include the Global Facility for Disaster Reduction and Recovery, Green for Growth Fund, and Sovereign Green Sukuk Framework.

Investments by climate funds in the region are small and highly concentrated. There are twelve climate funds operating in MENA with approved funding of \$1.5 billion, of which around \$1.0 billion in loans and \$0.5 billion in grants. Financing from these climate funds is directed toward a few countries (Egypt and Morocco together receive 47 percent) and a few large-scale projects, predominantly focused on mitigation.

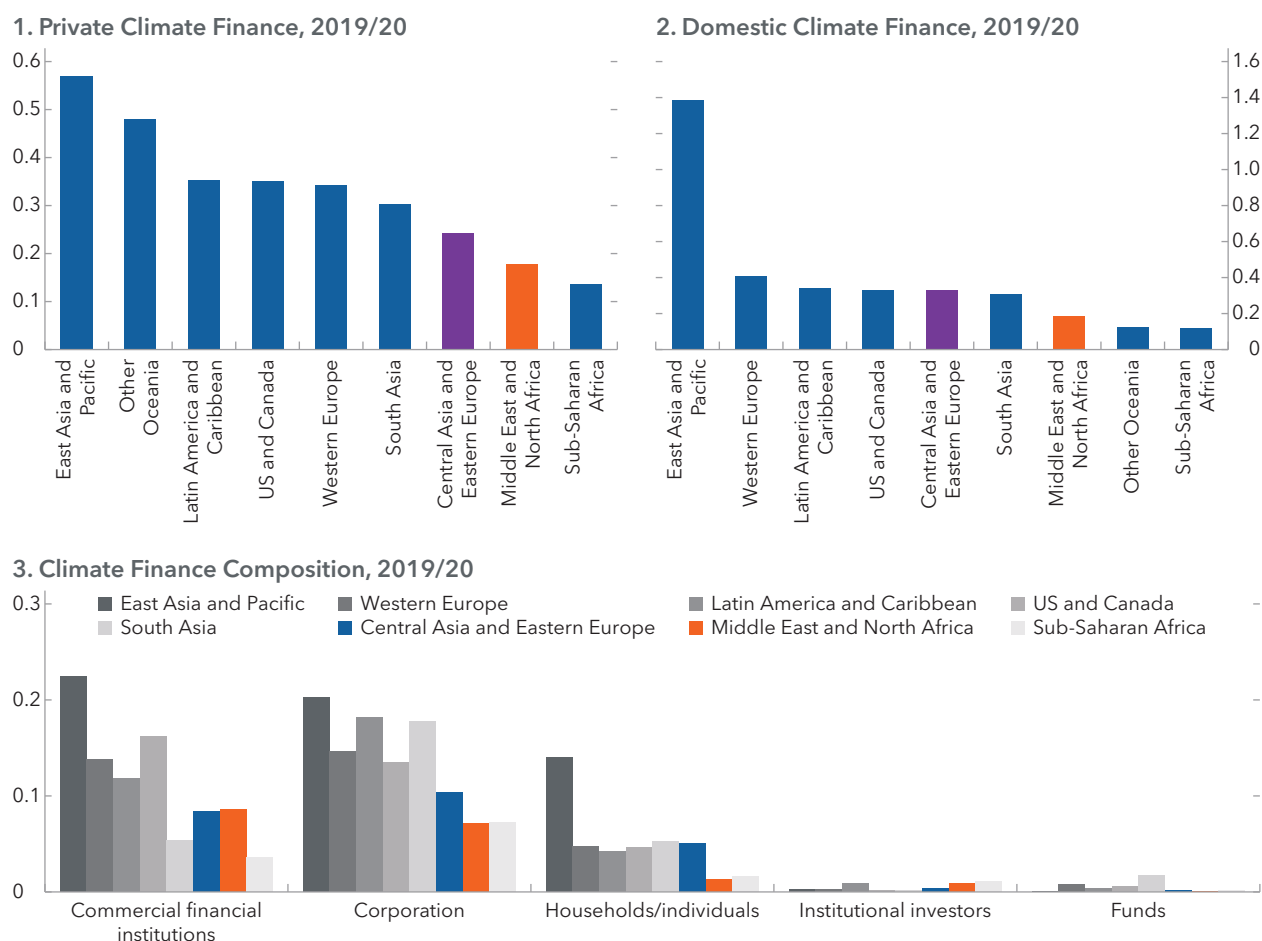
**Box Table 3.1. Funds Supporting the MENA Region, 2003-19 (Millions of US dollars)**

Fund	Amount Approved
Clean Technology Fund (CTF)	867.1
Green Climate Fund (GCF)	311.8
Global Environment Facility (GEF 4, 5, 6, 7)	138.3
Adaptation Fund	48.8
Special Climate Change Fund (SCCF)	43.5
Least Developed Countries Fund (LDCF)	35.1
Adaptation for Smallholder Agriculture Programme (ASAP)	22.6
Global Energy Efficiency and Renewable Energy Fund (GEEREF)	16.6
Partnership for Market Readiness	10.2
MDG Achievement Fund	7.6
Global Climate Change Alliance (GCCA)	3.4
Pilot Program for Climate Resilience (PPCR)	1.6
<b>Total</b>	<b>1506.6</b>

Source: Watson and Schalatek (2020).

Note: MENA = Middle East and North Africa.

**Figure 26. Private Climate Finance Composition, 2019/20**  
(Percent of GDP)



Sources: Climate Policy Initiative; and IMF staff calculations.

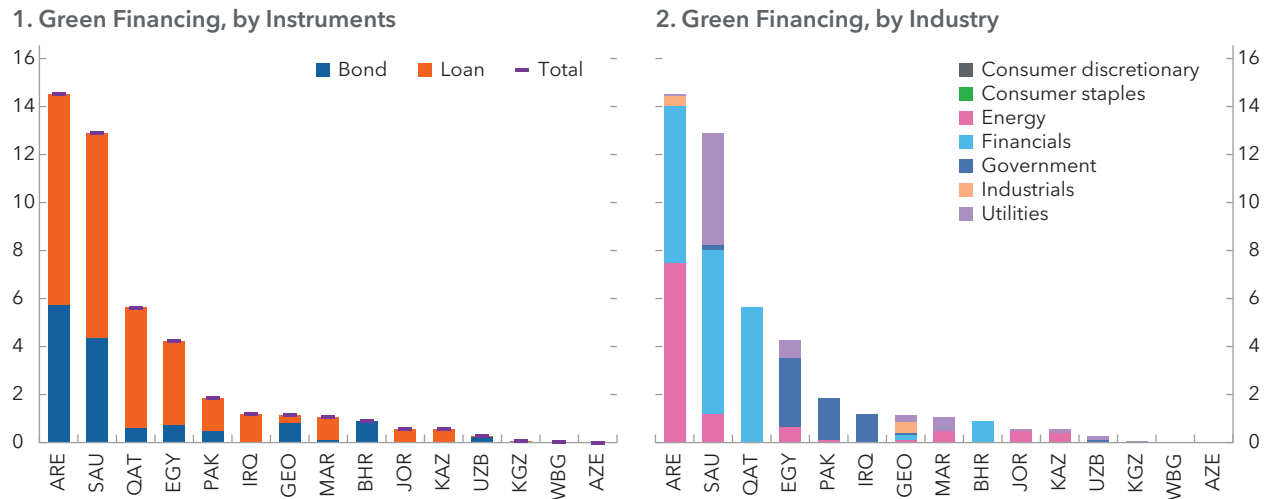
- Official climate funding primarily consists of debt financing (averaging 77.5 percent per year in 2018–20), with grants accounting for most of the remainder (21 percent).
- More than two-thirds of financial inflows to the MENA region are directed toward project financing.
- Concessional financing represents about 11 percent of total inflows in the MENA.

Public financing accounts for over half of the climate finance inflows, while the availability of private and domestic climate finance sources in the region remains limited (Figure 26). MENA has consistently ranked among the regions with the lowest levels of private climate finance, averaging around 0.2 percent of GDP in 2019 to 2020. The region significantly lags in most private finance sources, with the weakest participation coming from corporations and households. This underscores the limited role of the nonfinancial private sector within the region.<sup>30</sup>

Green bonds and loans remain confined to relatively large issuers and industries (Figure 27). Despite rapid development, supported also by the distinctive role of Islamic financial products (Box 4), by the end of 2021, out of the 32 countries in the region only 6 countries (3 of which are from the GCC region) had issued green

<sup>30</sup> IMF (2023a) estimates that in emerging market and developing economies, the contribution of the private sector should double from its current 40 percent by 2030 to cover climate mitigation investment needs.

**Figure 27. Green Financing by Instruments and Industry, 2003-22**  
(Billions of US dollars)



Source: BloombergNEF.

Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

or green-linked bonds, and 13 countries had issued green or green-linked loans. In the GCC region, mostly companies in energy and utilities sectors, along with financial institutions including sovereign wealth funds (SWFs), have been able to tap green financing to date.

Banks in the ME&CA region face similar challenges in green finance and investment to those in other regions, but these challenges are more pronounced in an environment where the necessary incentives are less developed. Multiple factors, such as demand and supply-side barriers to climate financing, as well as persistent climate policy uncertainty (IMF 2023b), constitute major obstacles to stronger engagement of many domestic private lenders:

- *Shortage of bankable projects, longer investment period and uncertain returns:* Green investments may involve higher upfront costs, longer payback periods, uncertain returns compared to conventional investments, and longer investment periods (the latter would require long-term funding). Moreover, estimating the potential financial benefits and assessing the environmental impact of green projects requires specialized skills and tools that may not be readily available to traditional lenders and borrowers. The lack of bankable projects often comes across as an issue in North Africa and the CCA.
- *Uncertain regulatory and policy frameworks:* Green investments are often subject to specific regulatory and policy frameworks aimed at promoting environmentally sustainable projects and climate-resilient infrastructure. Such frameworks may include renewable energy targets, emission reduction commitments, and environmental certification requirements. Domestic lenders need to navigate these complex rules, including procurement procedures, and understand how they affect the financing and viability of green projects; while failure to comply with them may result in financial penalties or reputational risk for lenders. Higher-income ME&CA countries are more advanced in terms of development and implementation of policy and regulatory frameworks.
- *Poor standardization and transparency:* The inability to apply standardized indicators in assessment and lack of unified reporting frameworks for green investments constitute challenges for banks across the region and other private lenders. Unlike conventional projects, where financial performance can be assessed on

## Box 4. Islamic Financial Instruments and Green Financing in the Middle East and Central Asia

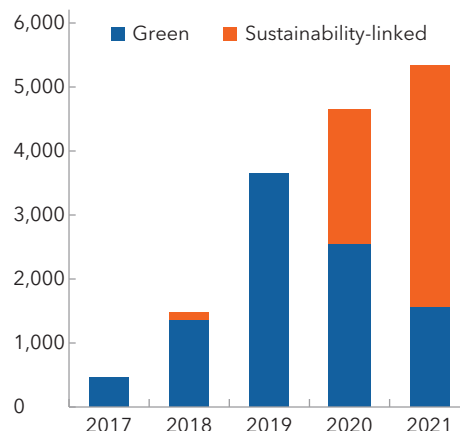
The first Middle East green bond was issued by a United Arab Emirates financial institution, First Abu Dhabi Bank, in 2017. It has since developed strongly and pretty much uniquely to the Middle East region (along with some countries in Asia, like Indonesia and Malaysia) with features of Islamic and green finance merging into new instruments. Islamic banks, with their long history of responsible investing and governance, may find it easier, to some extent, to adopt similar features for green instruments' governance, compliance, and risk-sharing principles.

The most common instruments are green or sustainable Islamic bonds (sukuks). Sustainable sukuks are Shari'ah-compliant financial instruments whose proceeds are used for the funding of eligible sustainability projects. Likewise, a green sukuk is a Shari'ah-compliant financial instrument in which issuers exclusively use the proceeds of the issuance to finance investments in renewable energy or other environmental assets (such as energy and infrastructure projects). This has evolved into a variety of products, including Shari'ah-compliant green deposits for households (for example, in Saudi Arabia).

Global issuance of sustainability-linked sukuk, which barely existed before the pandemic, surged in 2021, to \$3.8 billion from \$2.1 billion the year before. But green sukuk reversed course. Just \$1.8 billion worth of green sukuk were issued in 2021, compared with nearly \$2.6 billion the year before. The decline in green sukuk issuances is explained by high issuance costs, limited opportunities for funding decarbonization projects, and most importantly due to lack of common standards within and between markets. Despite this, numerous banks in the region have already advised upon or issued sustainable and green sukuk.

**Box Figure 4.1. ESG Sukuk Historical Insurance, 2017-21**

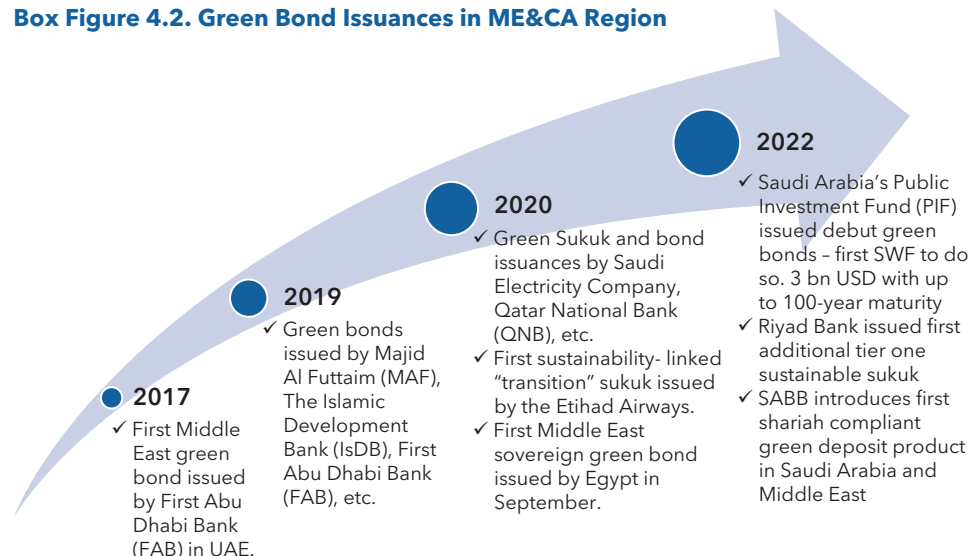
(Millions of US dollars)



Source: Refinitiv Eikon.

Note: ESG = environmental, social, and governance.

**Box Figure 4.2. Green Bond Issuances in ME&CA Region**



Source: IMF staff.

Note: SWF = sovereign wealth fund.

the basis of well-established indicators, a lack of consistent reporting and transparency standards can make it difficult for lenders to compare different green investment opportunities and accurately assess their risks and returns. This issue is prevalent across all ME&CA countries with green investment.

- *Significant asymmetries of information:* A somewhat related issue to poor standardization refers to limited access to reliable and relevant information. The lack of transparent and comprehensive data on climate-related investments creates uncertainty and inhibits lenders' ability to accurately assess the environmental impact and financial feasibility of such projects.<sup>31</sup> As a result, domestic lenders may be hesitant to allocate capital to climate investments, as they face challenges in accurately pricing risks and evaluating potential returns. This poses challenges for financing smaller projects and favors relationship-based banks in the region.
- *Operational and counterparty risk in a new field with little track record:* Such risks arise from potential challenges in implementing and managing complex systems, as well as possible disruptions to project execution (operational risks). Counterparty risks involve uncertainties associated with the reliability and financial stability of partners/stakeholders involved in climate projects. These risk factors deter investors and lenders from providing financial support if they seek assurances of project success and are particularly relevant in countries, such as low-income countries, where accounting and governance standards for nonfinancial firms still need substantial improvement (for example, part of the CCA and North Africa).
- *Insufficient capacity and expertise in project selection and development:* One of the key challenges for domestic lenders is limited expertise and knowledge of green investments. Green projects often involve complex technologies and environmental assessments that traditional lenders may be unfamiliar with. A lack of understanding of such technologies and the methodology for assessing them complicates making informed financial decisions. This often requires recourse to specialized third-party expertise (sometimes from outside of the country) that can come at a significant cost, especially in financial systems of the region that are least developed. Persistent challenges regarding limited capacity and expertise in project selection and development exist across all ME&CA countries.
- *Common pool/public asset issues:* When resources or assets, such as natural ecosystems, are collectively owned or managed, this creates challenges for domestic lenders in green investment in defining property rights, enforcing regulations, and ensuring equitable distribution of benefits. Although the latter is a significant challenge for mitigation purposes, it is a particularly strong impediment for the financing of adaptation needs (for example, protection of the shoreline or some water-related investments). Such challenges can impede the flow of capital toward green finance projects and hinder private investors' engagement in their financing, for example through PPPs.

In the face of wide-ranging barriers, incentives to develop green finance still need to be built up. Part of this is due to the significant data limitations and the lack of reliable and relevant information on what banks already provide as green financing. For the private sector, this is largely due to the general lack of mandatory disclosure, something still in its infancy in the region, with a limited traceability as a result. The inability to assess financing needs, for example on an annual or medium-term basis (three to five years) makes it challenging for climate finance practitioners to determine how much progress, if any, is being made toward meeting financing needs. Without standardized taxonomies and regulations, banks lack incentives to report and develop their exposures, even if they launch green financing products like green bonds.<sup>32</sup> Consequently, estimating the contribution of domestic financial sectors to green financing in the ME&CA region remains challenging, leading to potential overestimations or underestimations of progress.

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<sup>31</sup> They may also face difficulties in adapting their financing strategies to the unique requirements of green investment, including the need for patient capital.

<sup>32</sup> See, for example, The Rockefeller Foundation and BCG (2022).

## B. Scaling Up Opportunities for Financing the Green Economy and the Role of the Domestic Financial Sectors

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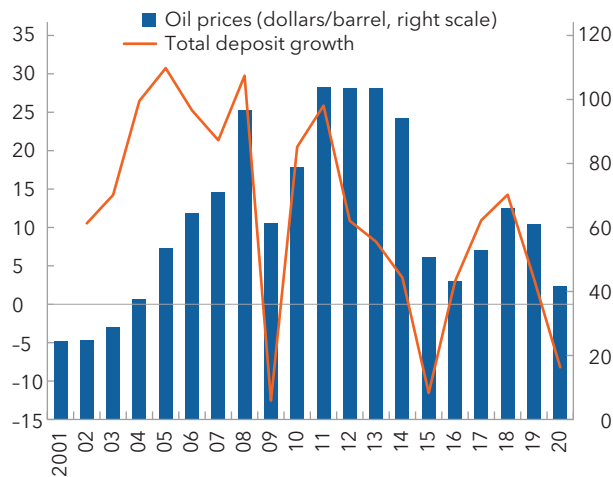
ME&CA banks can significantly help in meeting domestic green financing needs by channeling domestic savings and leveraging comparative advantages of bank intermediation. With much of the current focus on disintermediated, cross-border, and concessional finance, less attention has been paid to the role of domestic financial sectors in developing green finance. Domestic banking systems, if also supported by sufficiently developed capital markets, can further mobilize and reallocate domestic savings for green investment needs. Moreover, there are also some segments of climate finance where bank intermediation in the region, as elsewhere, has comparative advantages and opportunities. This is evident in retail banking (both for households and firms), where factors such as size, economies of scale, and information asymmetries are important considerations.

Increasing energy efficiency among domestic firms and households is a primary opportunity for banks to support a greener economy. For instance, the real estate sector (whether for commercial or residential use) has the second largest mitigation financing needs after the power industry, estimated at approximately \$660 billion globally (Rockefeller Foundation and BCG 2022). Energy efficiency is a key component of this effort and offers scope for bankable projects where, for example, banks can obtain funding from international financial institutions (IFIs) (such as the European Bank for Reconstruction and Development and the International Finance Corporation) at maturities that more closely match the return on such investments (as has been demonstrated in other regions, such as in Central and Eastern Europe). However, complementary efforts are needed by policymakers to stimulate demand for energy efficiency investment, including by raising energy costs by eliminating subsidies or introducing other economic incentives. This is particularly relevant for household lending, where relatively small projects related to energy efficiency (for example, more efficient air conditioning and insulation, or the purchase of electric vehicles) or adaptation require sufficient price incentives (for example, fuel and electricity). The issue is similar for water efficiency investments, where setting the price of water to reflect its actual cost, and often its scarcity in the region (for example, in the GCC), is key to making projects both viable and bankable.

Banks also have a role to play in providing what is called “green inclusive” finance. Green inclusive finance has two goals: to increase customers’ climate resilience, particularly among the most vulnerable, and at the same time protect the environment. Many banks in ME&CA region already offer green financial products to their customers, mostly linked to green technologies and sustainable agriculture practices:

- In several countries, banks are proactively developing green and sustainable products for small and medium enterprises and customers (for example, Morocco, Tunisia, or Yemen). This is prompted by the need to respond to high and volatile oil prices. For example, in Yemen, Al Amal Bank provides interest-free products to farmers and households that transition to solar energy and solutions, with the interest being collected from suppliers. In other countries, banks are considering financing for solar generators and water pumps to enhance business resilience and mitigate the impact of rising fuel costs.
- Coupling risk insurance and guarantees with sustainable development frameworks can also help the financial sectors in the region to develop green finance for small and medium enterprises or offer micro-finance to low-income and self-employed groups.
- IFIs can play a special role here by offering necessary guarantees and assurances to co-invest, along with helping the capacity building of local investors. For example, the European Bank for Reconstruction and Development and the International Finance Corporation are actively involved in the provision of credit lines that are managed by domestic banks, leveraging on local banks’ knowledge of their borrowers and their ability to monitor projects.

**Figure 28. Total Deposit Growth in Commercial Banks of Oil Exporters**  
(Percent)



Source: IMF staff calculations.

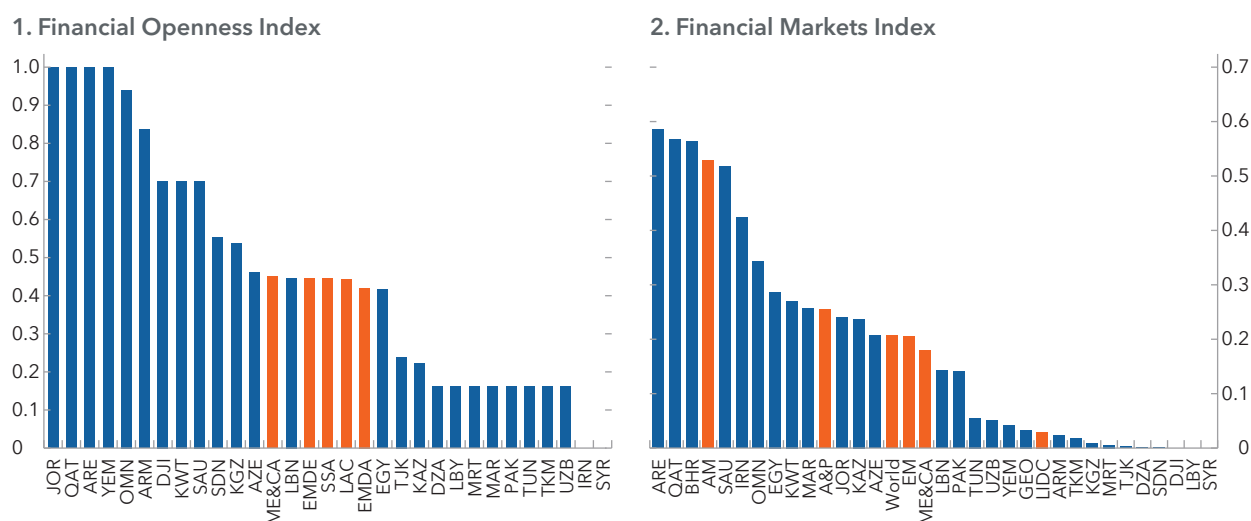
Green finance also presents an opportunity for banks to diversify their balance sheets, further strengthening their resilience to climate risks. Although efforts have been made in several oil-exporting countries in the region to sever bank liquidity developments from oil prices (for example, by holding profits from oil exports offshore, or through a fiscal policy overall less prone to booms and busts), there is still a strong link between bank funding and hydrocarbon prices (Figure 28). This constitutes a significant vulnerability for the most dependent banking sectors, potentially hampering the growth of their lending activities, as their economies transition to lower carbon prices and a less carbon-intensive future. Diversifying early, including through green financing, and preparing for this transition on both the asset and liability side will be key. In non-commodity-exporting countries, diversifying sources of funding and developing an

asset and liability management policy with a green component will be central to meeting domestic climate objectives. To some extent, this is achieved by specific funding products, which de facto tie the proceeds to green projects (for example, most green bonds albeit with varying degrees of granularity and specific commitments). Moreover, banks in the region are also developing and introducing transition linked bonds and loans, with the proceeds going toward projects that support the energy transition.

Though often less reliant on domestic financial sectors, large firms, including SOEs and energy companies, could also play a role in driving sustainable finance. This is due to their size, emissions intensity, public ownership, and centrality to national economies in the ME&CA region. The prominent role of SOEs in the region's growth and development strategies could also advance green transition under certain conditions, provided that they do not crowd out but crowd in the private sector.<sup>33</sup> While the economic challenges associated with large SOE presence are well documented (Ramirez Rigo and others 2021; OECD 2013), these entities can also increase their role in devising green and sustainable initiatives, particularly given their dominance in some countries and sectors (for example, in the energy industry). For instance, significant efforts are being undertaken by large fossil fuel extraction companies (like Aramco or Abu Dhabi National Oil Company) to reduce their carbon footprint, though in many cases these efforts are not dependent on support from the domestic financial sector as these companies have the resources and know-how to engage in such policies. Over time, though, they can also contribute to the development of green solutions and financial products that would permeate domestic capital markets and allow them to develop.

Further development of domestic capital markets will help catalyze private and other official sources of green finance. Recent financial innovations in the region (for example, blending green and Islamic finance), alongside a surge in green bond issuance (albeit from a low level and limited to some issuers), point toward positive developments. However, some challenges related to the depth and complexity of markets are fundamentally similar to those encountered in the development of other segments of finance (for example, need for longer maturities and refinancing, such as in the case of mortgages). This is in addition to the obstacles that hinder the development of financial markets in many ME&CA countries, including weakness in

<sup>33</sup> For instance, 30 companies in the United Arab Emirates committed to stepping up their efforts to combat climate change by measuring their carbon footprint and taking concrete steps to reduce it, and by integrating sustainability principles across their operations.

**Figure 29. Financial Development Indices, 2021**

Sources: Chinn-Ito Index; and IMF staff calculations.

Note: In panel 1, the Chinn-Ito financial openness index is a de jure measure of the openness to cross-border financial transactions. Greater values indicated a higher degree of openness. In panel 2, the Financial Markets Index aggregates measures of the depth, access level, and efficiency of financial markets. Data labels in the figure use International Organization for Standardization (ISO) country codes. A&P = Asia and Pacific; AM = advanced markets; EM = emerging markets; EMDA = emerging and developing Asia; EMDE = emerging and developing Europe; LAC = Latin America and the Caribbean; LIDC = low-income and development countries; ME&CA = Middle East and Central Asia; SSA = sub-Saharan Africa.

regulatory and legal frameworks, infrastructure gaps, and cross-border capital flow constraints (Figure 29). Both central banks and financial sector regulators have a role to play, as they can shape financial regulations and support the development of financial market infrastructure, thereby promoting the deepening of domestic markets (see Annex 4).

Unique to the region is a prominent role played by SWFs in oil-exporting countries in supporting the long-term development of climate finance in their home countries and the rest of the region. SWFs' characteristics, particularly their long-term investment strategies and their contribution to economic and financial diversification, make them well-suited to finance the transition to a green economy. The ME&CA region is home to some of the world's largest SWFs, with 16 regional SWFs collectively managing assets above \$4.8 trillion,<sup>34</sup> mostly concentrated in GCC countries. Their involvement in climate finance remains limited compared to the size of their overall portfolios but is rapidly progressing while their share of investments within their respective economies varies significantly. This underscores the combination of objectives encompassing economic diversification as well as pure financial diversification (for example, by holding a diverse portfolio abroad, shielded from commodity price fluctuations). In that context, significant developments and trends include the following:

- The important role that some of the SWFs have in economic diversification and domestic investment, such as Saudi Arabia's Public Investment Fund and the United Arab Emirate's Mubadala (for details on the different approaches followed by individual SWFs in the region, see Annex 4. Through the operations of SWFs, some large mitigation projects (for example, solar and wind farms) are already being financed domestically. Saudi Arabia's SWF, for example, has a specific mandate to lead the development of renewable energy and reach a renewable energy target as part of Saudi Arabia's Vision 2030.

<sup>34</sup> For details, see Global SWF.



- The potential role of SWFs in acting as a credible state-owned minority partner attracting international and local private investors and leveraging the scale of the fast-growing green investment funds investments (IMF 2021). This includes co-investing jointly with asset managers, private equity funds, and institutional investors in green and sustainable projects, benefiting from the experience of each other. For example, the experience of the One Planet Sovereign Wealth Funds Network suggests that increased cooperation among SWFs, asset managers, and private equity funds can contribute to investments in incipient clean hydrogen while accelerating investments in renewable energy globally.
- Perhaps as importantly, several SWFs from the region (from Oman, Saudi Arabia, United Arab Emirates, and others) are also taking a leading role in providing climate finance in other countries of the region through individual projects mostly in mitigation, for example, in Egypt and Morocco (see Annex 4).

Domestic financial sectors and markets can have an important supporting role in developing a full-fledged “green” ecosystem, especially in the context of diversification efforts in oil-producing countries. This not only includes the necessary emergence of a whole chain of economic agents able to develop a green economy (for example, local producers of wind or solar equipment), with sufficient technical capacity (for example, to build a circular economy) and that can become borrowers for bankable projects as well as funders of green finance. It also implies the development of relevant pricing mechanisms and market signals, notably to make the financing of the green economy a profitable and attractive endeavor, with adequately priced collateral. The development of carbon markets could offer such an opportunity, including for lenders, namely domestic banks, to better signal prices, and for firms to fund themselves more easily. Voluntary carbon markets are at a promising inception in the region but also need strong incentives on the price side (for example, higher prices for fossil fuel energy) to fully develop as in other regions (Box 5).

### **Box 5. The Development of Carbon Pricing Mechanisms and Carbon Markets in the Middle East and Central Asia**

Carbon pricing mechanisms are essential policy tools for climate change mitigation. There are two main mechanisms for carbon pricing: (1) taxation of carbon dioxide emissions, for example through taxes on the supply of fossil fuels; and (2) cap-and-trade emission trading systems, which are market-based policies requiring all covered entities to hold quantitative allowances for their emissions. The total quantity of available allowances is capped, and their price is determined through market trading. The latter most commonly leads to the development of carbon markets. Carbon pricing mechanisms shift the cost of carbon dioxide and other greenhouse gas emissions from the public back to the emitters, helping to overcome the externalities associated with polluting activities. By requiring emitters to internalize the cost of their greenhouse gas emissions, they can encourage lower energy consumption and investment in cleaner and more efficient technology.

Carbon-pricing mechanisms have crucial implications for climate finance. Indeed, these mechanisms increase the private financial return on low-carbon investment relative to more polluting alternatives (Heine and others 2019) and help align it with social and environmental returns. Higher private return on green investment could incentivize spending on mitigation and adaptation technologies and demand for green financing. This is particularly the case if carbon pricing mechanisms are stable, credible, and transparent as investments in green technologies often require large, upfront payments and only pay off over long timeframes (IMF, 2019b).

### Box 5. (continued)

As of early 2023, there were 70 carbon pricing mechanisms globally, covering 47 jurisdictions.<sup>1</sup> Among Middle East and Central Asia (ME&CA) countries, Kazakhstan has a carbon pricing mechanism in place in the form of an emission trading system. An emission trading system is also under consideration in Pakistan. Egypt EGX has finalized contracts for the supply of fintech technology for a carbon credit platform for Africa's first voluntary carbon market and is expected to be launched in 2023.

Meanwhile, Saudi Arabia and the United Arab Emirates have taken steps to establish voluntary carbon trading systems, although these do not rest on government-mandated carbon limits and a cap-and-trade mechanism to introduce a cost for carbon emissions, with the incentive to participate depending on voluntary commitments to reduce and offset emissions (in the spirit of the Paris Agreement and in response to investor and customer demand):

- Saudi Arabia's Public Investment Fund held a large auction of carbon credits in October 2022 and, in cooperation with the domestic stock exchange, Saudi Tadawul, announced the establishment of a regional voluntary exchange platform for offsets and carbon credits.
- In the United Arab Emirates, a carbon trading platform is being explored by the Dubai Carbon Centre of Excellence. The United Arab Emirates' ADGM is working on a framework for the first-ever regulated voluntary carbon market, while its Financial Services Authorities implemented regulatory changes that made voluntary carbon credits a tradable financial instrument on the ADGM.

While voluntary carbon markets can contribute to the creation of financial return mechanisms as well as valuable collateral instruments, the lack of depth, efficiency, and transparency in pricing can also lead to unpredictable revenue streams. Overall, the practice is still in its infancy in the region while there is also limited demand and supply.

A global carbon trading system may, however, raise specific challenges for the ME&CA region. It is estimated that under a future global carbon trading system compatible with Article 6 of the Paris Agreement, nearly all ME&CA countries are likely to be net buyers of carbon credit emissions rights and hence experience financial outflows, while most other emerging market and developing countries are projected to attract inflows (IETA 2021). This disequilibrium might be even more prevalent at the regional level, limiting the potential of such markets. This reflects limited land availability for nature-based carbon offsets (for example, lack of green forest cover for carbon credits) and large populations in ME&CA and underscores the importance of fostering green finance development to meet the region's mounting climate financing needs.

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<sup>1</sup> See <https://carbonpricingdashboard.worldbank.org/>.

## 5. Policy Considerations

ME&CA countries face sizable financing needs to achieve climate goals relative to currently available green funding. While green finance development is in progress in ME&CA countries, it is still nascent for the region. For successful climate financing, the region's financial sectors must efficiently channel both domestic and global savings. This necessitates policy actions and coordinated regulatory efforts to strengthen the resilience of financial sectors against physical and transitions risks and promote better adoption of green finance. A strategic approach is recommended, taking into account each country's financial development, income per capita, and progress in financing the green transition. Unlocking private green finance is crucial for a successful transition to a low-carbon economy in the region.

In the near term, policy efforts in the region should center on (1) better measuring, understanding, and disclosing climate risk data, as well as developing robust models capable of assessing the impact of climate risk on financial sector institutions (this aligns with global efforts for consistent and comparable risk measurements and assessments, undertaken by standard-setting bodies like the Basel Committee, the International Association of Insurance Supervisors, as well as the Network for Greening the Financial Sector and industry groups); and (2) finalizing climate strategies and creating green financial ecosystems (which entail setting sustainable finance frameworks and responsible investment taxonomies, improving access to reliable information on climate-related investments and green products, and building capacity to overcome constraints with the implementation of climate-related measures).

To enhance the resilience of financial sectors to climate change-related risks, it will be important to (see also Table 1):

- *Better measure and understand climate risks:* Effective climate risk management begins with accurate measurement and understanding of such risks. Policy actions should continue to prioritize the implementation of standardized methodologies for quantifying and reporting climate risks. This entails developing comprehensive frameworks that capture both physical risks (for example, extreme weather events and sea level rise) and transition risks (for example, policy changes and consumers' preferences shift). By adopting consistent methodologies and metrics, financial institutions (as well as their regulators and supervisors) can better assess and compare their exposure to climate risks, facilitating informed decision-making processes.
- *Promote climate risk data disclosure by financial institutions:* Transparency plays a pivotal role in promoting market efficiency and fostering prudent management of risks. This disclosure should extend beyond just compliance and striving for comprehensive and consistent reporting, to enable stakeholders to make informed assessments of an institution's exposure to climate-related risks. Standardized reporting frameworks, such as those proposed by initiatives like the Task Force on Climate-related Financial Disclosures and International Sustainability Standards Board, can provide guidance to the ME&CA region on best practices in climate risk disclosure.
- *Develop new and enhance existing climate risk models and climate forecasting:* As climate risks evolve, it becomes imperative to assess their potential impact on the resilience of financial sectors in the region. Policy actions should prioritize the development of robust models capable of evaluating and quantifying the implications of climate risks on financial institutions. These models should consider various scenarios and stress tests, integrating both physical and transition risks. By comprehensively assessing potential impacts, financial institutions can identify vulnerabilities, allocate resources effectively, and implement necessary risk management strategies.

**Table 1. Policies to Strengthen the Bank Resilience to Climate Events**

Policy Measures	Actions	Higher-Income ME&CA	ME&CA EMDEs	ME&CA LICs	ME&CA FCS
<b>Risk methodologies</b>	Better measure, understand, and quantify climate risk exposure				
<b>Risk models</b>	Develop or enhance climate risk models and forecasting				
<b>Data disclosures</b>	Strengthen the disclosure of climate risk data				
<b>Risk management</b>	Adopt robust climate risk management policies and practices				
<b>Risk awareness</b>	Promoting awareness, knowledge sharing and cooperation in the financial sector and with relevant stakeholders to support a better understanding of climate risks				
<b>Development of the insurance and reinsurance sector</b>	Initiatives to create mandatory disaster insurance fund/s, encouraging public-private insurance schemes, leveraging the reinsurance market.				

	Less than half of the countries
	More than half but less than three-fourths of the countries
	Over three-fourths of the countries

Source: IMF staff.

Note: EMDEs = emerging market and developing economies; FCS = fragile and conflict-affected states; LICs = low-income countries; ME&CA = Middle East and Central Asia.

- Adopt sound climate risk management in financial sector institutions:* This involves gathering reliable, up-to-date information on climate-related exposures and vulnerabilities, and enhancing risk governance, internal controls, and accountabilities within financial institutions, as well as ensuring that climate risks are properly identified, monitored, and managed at all levels. This includes the development of robust risk management policies and practices and may require changing some existing liquidity and credit policies (for example, shortening loan maturities in carbon-intensive sectors), creating stronger capital buffers, and setting up thresholds on asset concentration, leverage, or specific sectoral exposures (see Table 2 on possible macroprudential tools). Additionally, supervisors could consider implementing specific carbon stress tests to assess financial institution resilience in different scenarios. Moreover, promoting knowledge sharing and cooperation in the financial sector and with relevant stakeholders can foster a better understanding of climate risks and encourage the adoption of best practices. On the other hand, green investments offer opportunities for further diversification of financial institutions' portfolios toward these products.

Table 2. Potential New Macroprudential Tools and Measures

Area of Vulnerability	Capital		Concentration		Leverage	Sectoral Exposures	
<b>Macroprudential Tool</b>	Capital conservation buffer	Counter-cyclical capital buffer	Concentration threshold	Concentration charge	Sectoral leverage ratio	Sector specific requirements (e.g.: risk weights)	Sectoral systemic risk buffer
<b>Policy Purpose</b>	Increase resilience	Prevent build-up of risks, increase resilience	Reduce excessive concentration	Increase targeted resilience/reduce concentration	Increase resilience	Increase targeted resilience	Increase targeted resilience
<b>Potential Drawbacks</b>	Non-targeted measure	Cyclical nature of climate risk unclear	Complexity in classification of geographical/sectoral exposures	Complexity in classification of geographical/sectoral exposures	General function as non-risk-based measure	Impact on micro-prudential requirements	Challenging calibration
<b>Novelty in Macroprudential Toolkit</b>	No	No	No	Yes	No	Yes	No

Sources: European Central Bank (2022), and IMF staff.

- *Support the development of the insurance sector:* Supporting the development of the insurance sector will require supervisory authorities to develop tools to manage climate risks. These measures need to be complemented by policy interventions to leverage the reinsurance market and to incentivize private sector participation. The reinsurance market is better placed to absorb high-cost climate-related shocks due to a more diversified insurance portfolio, higher underwriting capacity, as well as integration in the global insurance market as such. Creating national reserve funds for natural disasters or mandatory natural disaster insurance funds (like in Iran) for countries that are particularly vulnerable to climate disasters would also contribute to reducing the insurance protection gap (see also Annex 3 on the role of reinsurance).

To create a more conducive ecosystem for the development of green finance, it will be crucial to (see Table 3):

- *Finalize climate strategies and support sustainable finance frameworks:* The work on developing and enhancing climate or sustainable finance frameworks should continue in line with countries' climate strategies. The most progress has been achieved on NDCs and associated strategies (see Table 4). The frameworks alongside other related government strategies would need to reaffirm the ME&CA countries'

**Table 3. Financial Sector Actions to Facilitate Private Green Financing**

Actions	Recommendations	Developed Financial Sector	Financial Sector Under Development	Underdeveloped Financial Sector
<b>Near-Term Priorities</b>				
<b>Sustainable Finance Frameworks</b>	Sustainable finance strategy/frameworks			
<b>Disclosures/ Standards</b>	Sustainable finance standards, disclosure of climate risks, standards for green investment products.			
<b>Innovative Products</b>	Development of innovative products and services to finance green investment			
<b>Medium- to Long-Term Priorities</b>				
<b>Carbon Pricing</b>	Development and use of carbon trading markets and valuation			
<b>Local Capital Markets Deepening</b>	Initiatives to create and promote the development of efficient, scalable, and sound capital markets (for example, in domestic currency)			

	Low or no implementation
	Some of the countries
	Most of the countries

Source: IMF staff.

ambition to address climate and environmental challenges; be integrated in broader frameworks; set up clearer, coordinated, and more detailed objectives; lay out practical steps to drive progress; and identify needed and available and potential financing over a defined timeline, including for private finance.

- *Develop a climate sustainability classification system at the national and regional levels and promote enhanced disclosures:* To operationalize climate strategies and sustainable finance frameworks, ME&CA countries would need to develop and, in several countries, finalize and disseminate a sustainable finance taxonomy, which provides a standardized set of criteria for green finance products, as well as disclosure requirements on environmentally responsible investment. Regional cooperation, which is already developing in the region (for example, the GCC), offers a prime opportunity to use economies of scale and implement regional taxonomies and standards for deeper markets.
- *Translate climate strategies into a pipeline of green bankable projects, which requires cooperation between public and private sectors as well as IFIs and multilateral development banks:* These would not only expand existing green products but also facilitate the adoption and development of innovative new green products and services. Innovative finance instruments can overcome some of the challenges and help broaden the investor base. Multilateral development banks are crucial to leverage private investment and provide risk-absorption capacity. The IMF can play a catalytic role through its policy advice, surveillance, and capacity development, as well as through financing and policy design from its Resilience and Sustainability Trust, which could help tackle longer-term structural challenges arising from climate change (IMF 2022a). More broadly, IFIs can promote macro de-risking with credible regulations, transparency, governance, and macroeconomic sustainability. Meanwhile, multilateral development banks and other technical assistance providers (such as the Energy Transformation Accelerated Financing in Abu Dhabi) can help project-level de-risking with standardized green projects contracts. Regional projects, like the Climate Finance Access and Mobilization Strategy for Central Asia and South Caucasus (2023–30) by the United Nations, could help channel limited climate finance flows to better match national and regional climate finance needs. Similarly, the UN Economic Commission for Europe-led project, aimed at transforming the construction sector for climate goals in Eastern Europe, Central Asia, and the Caucasus, should assist in preparing the building supply chain industry to deliver the necessary materials, technology, and equipment. This will improve the energy performance of buildings, reduce embodied carbon, and enhance the energy efficiency of the building and construction sectors. Additionally, the World Bank has found that enhancing regional power trade in Central Asia could generate \$6.4 billion, while enabling climate-friendly investment (Myroshnychenko and Owen 2016).
- *Further develop green finance products and financing mechanisms:* While some ME&CA countries have already implemented climate financing mechanisms and policy measures, there remains significant room for growth in the utilization of green bonds and loans, including sovereign and corporate bonds and loans, as well as sustainability-linked bonds and loans. Governments can unlock this potential by enhancing financial regulations and implementing stronger incentives (including tax incentives) to attract capital providers. Additionally, there is a notable opportunity to expand the use and accessibility of Shari’ah-compliant green financial instruments in the region, including green sukuk.

Governments, central banks, and financial regulators will be essential in creating an enabling market environment that supports a greener economy through private green finance, and improving the viability of climate-related investments (see Table 4):

- *The role of governments:* Governments in the ME&CA region play a crucial role in creating appropriate conditions for the mobilization and channeling of climate finance:
  - Governments’ remit includes implementing policies that promote climate-sustainable investment (incentives and market mechanisms) and regularly upgrading laws, regulations, and standards (for example, related to emissions, recycling, and building codes, etc.) to align with global decarbonization

**Table 4. Enabling Environment for Private Green Finance**

Actions	Recommendations	Higher-Income ME&CA	ME&CA EMDEs	ME&CA LICs and FCS
<b>Climate Commitments</b>	Sustainability targets, pledges, and commitments (NDCs, etc.)			
<b>Near-Term Priorities</b>				
<b>Taxonomies</b>	Sustainable finance taxonomies			
<b>Operationalization of Climate Commitments</b>	Inclusion of climate-related objectives in government policy frameworks and mandates			
<b>Data Standards and Sharing</b>	Disclosures, standards, verifiable indicators to regulate green investments; emission monitoring and verification			
<b>Awareness</b>	Green finance awareness and education initiatives			
<b>Medium- to Long-Term Priorities</b>				
<b>Energy and Utility Subsidy Reform</b>	Gradual removal of subsidies to reduce demand and enhance carbon market pricing			
<b>Supporting Regulations</b>	PPP laws, public procurement agreements, etc.			
<b>Market Facilitation Efforts</b>	Guarantees, subsidizing issuance costs; super ESCOs; green investment funds and banks; assisting in the issuance of climate-related products			
<b>Green Investment Promotion</b>	Public investments and incentives (tax and nontax), and initiatives to promote green investing (R&D funding, technical assistance, viable projects' pipeline development, commercialization and finance of green technologies)			

	Low or no implementation
	Some of the countries
	Most of the countries

Source: IMF staff.

Note: EMDEs = emerging market and developing economies; ESCOs = energy service companies; FCS = fragile and conflict-affected states; LICs = low-income countries; ME&CA = Middle East and Central Asia; NDCs = nationally determined contributions; PPP = public-private partnership; R&D = research and development.

efforts. Complying with emerging international standards and adopting recognized sustainable finance frameworks can help address governance issues. Upgrading relevant laws and regulations, such as those governing PPPs, while further liberalizing foreign direct investment regimes can further promote the mainstreaming of climate finance and ensure they are conducive to scaling up green financing.



- Phasing out energy subsidies and adequate carbon pricing policies should be a policy priority for governments in the region. In respect to subsidies, doing so will be both an opportunity and a challenge as explicit subsidies of oil products, natural gas, coal, and electricity represent in ME&CA countries \$389 billion in 2022 (or around 7 percent of GDP on average for a country), and \$336 billion in MENA countries alone. (For more country details and data go to <https://www.imf.org/en/Topics/climate-change/energy-subsidies>.) Eliminating these subsidies would not only reduce incentives for fossil fuel consumption, contribute to reaching climate mitigation targets, and contain the size of investment needs but also enhance the bankability of climate-related investment projects by reaching market prices.<sup>35</sup> This, in turn, would also create fiscal space for climate investments that can also be undertaken through greater private sector participation. A recent positive development for ME&CA countries is that the buildup in renewable energy can take place with much lower energy prices than in the past (the cost of solar energy per kilowatt-hour has decreased substantially in recent projects in ME&CA), hence requiring comparably less incentives, in particular subsidies, from governments (as opposed to the situation in advanced economies with the nascent renewable energy production a few years ago). With ample sun and wind resources, this a considerable opportunity for many countries in the ME&CA region. Broader climate policies and such carbon pricing will support private green finance by making the risk/return profile of climate projects more attractive.
- *The role of central banks and financial regulators:* Apart from encouraging more transparency and disclosure of climate-related risks, which would enable investors to make informed decisions and direct capital toward green investments, central banks and financial regulators of the region can play an important role in promoting sustainable finance. This involves providing guidelines and requiring banks to submit supervisory reporting of detailed data on climate-related exposures, and issuing guidance on incorporating climate factors into investment decisions and establishing and enforcing standards for reporting and disclosing green exposures. Central banks and financial regulators can also actively participate in international collaborations and networks dedicated to green finance, fostering knowledge sharing and best practices (see Annex 5).<sup>36</sup>
- *Development of new tools and markets:* The use of the new international carbon market and the development of domestic carbon pricing frameworks (including carbon markets) can further stimulate demand for investments in renewable energy and low-carbon technologies. By establishing carbon pricing mechanisms and carbon trading markets, including regional ones, there is an opportunity to incentivize investment in mitigation and adaptation measures, and broaden the range of tools available for green financing. Regional carbon markets are particularly advantageous, as they offer cost-effective solutions compared to smaller national markets. Supporting domestic market facilitators, such as Green Investment Banks or Funds (Bahrain), Super Energy Service Companies (Egypt and United Arab Emirates), and coordinating platforms (IRENA Climate investment Platform) that match projects with investors, can also help overcome financial and nonfinancial barriers and unlock emerging markets.
- *Climate awareness and architecture:* Raising awareness about climate risks associated with a potential inaction across all sectors and actors is critical.<sup>37</sup> Additionally, most of the ME&CA region would benefit from developing capacity-building programs in green finance to facilitate project origination and implementation, as well as climate awareness and training to promote responsible investment and the

<sup>35</sup> For Saudi Arabia, for example, IMF (2023c) estimates that eliminating fuel subsidies by 2030 as currently envisaged would help achieve one-third of the country's mitigation targets. Anderson and others (2022) show that additional investments of \$770 billion in MENAP (20 percent of 2021 GDP) and 114 billion (27 percent of 2021 GDP) in the CCA between 2023 and 2030 would allow achieving the region's emission reduction targets with fuel subsidies reduced by two-thirds and without any carbon tax.

<sup>36</sup> Several ME&CA central banks and financial sector supervisors, representing about a third of the countries in the region, have joined the Network for Greening the Financial System, which promotes the development of opportunities relating to green finance and redirection of capital by financial institutions toward green and sustainable investments, and formulates policy proposals.

<sup>37</sup> For example, Egypt's Financial and Regulatory Authority launched the Regional Centre for Sustainable Finance in March 2021 to coordinate training and educational institutes providing services to nonbank financial institutions in Egypt and the MENA.

integration of green finance principles into financial decision making and risk management processes. The finalization of a climate information architecture, including through the establishment of data dashboards and reliable data sources, would buttress these efforts.

- *Development of local capital markets and their deepening:* Prioritizing initiatives that foster the development of robust and efficient capital markets is crucial. This would include (1) enhancing regulatory frameworks to provide strong legal protections and consistent corporate governance rules by implementing higher standards, thereby improving investor confidence and market transparency; (2) working toward increasing market depth and liquidity by broadening the range of securities for trade, introducing derivative instruments, corporate bonds, and green bonds to offer more diverse investment opportunities; (3) upgrading financial and technological infrastructure through the modernization of electronic trading platforms to facilitate efficient price discovery and attract a wider range of investors; (4) facilitating better access to international markets and aligning with international standards to draw in foreign capital; (5) encouraging the development of sound risk management practices through strengthening risk management frameworks and credit rating agencies, essential for accurately assessing the risk profiles of securities; and (6) supporting sound macroeconomic policies as they are crucial for creating a conducive environment for long-term capital market development in ME&CA countries. Additionally, addressing currency risks in climate projects funding is vital. The high cost of commercial hedging, due to underdeveloped foreign exchange derivatives markets, can render investment uneconomical. Implementing foreign exchange hedging facilities for climate-related investments can lower those risks by reducing hedging costs to acceptable levels. As foreign exchange derivatives markets mature, their role can be gradually diminished.
- *Initiatives to coordinate climate finance:* Initiatives to share best practices, identify barriers to accelerating green finance, and get feedback from market participants regarding new rules, standards, or products could help facilitate climate finance development.

Encouraging collaboration and coordination between the private and public sectors, including SWFs and SOEs, as well as fostering regional collaboration, could help bridge the financing gap in the ME&CA region. Specifically:

- SOEs, being significant contributors to the ME&CA countries' economies and given their environmental footprint, can contribute to the climate transition by committing to net zero and prioritizing core business resilience to climate risks.
- Moreover, ME&CA SWFs, with their substantial assets and long-term investment horizons, can go beyond domestic investment to attract international and local private investors, thereby facilitating and catalyzing green investments in the region. They can also contribute to the capacity building and dissemination of best practices, standards, and sustainable finance frameworks in the region and through other key financial actors.
- New financing models (including blended finance) and PPPs with multilateral or government actors could ensure availability of needed scalable financing for energy transition while also overcome existing barriers (for example, to market entry, etc.).
- Regional collaboration, potentially through the facilitation of existing cooperation frameworks, like the GCC, holds the potential to deliver stronger returns and superior outcomes compared to individual country efforts. For example, Saudi Arabia is spearheading the Middle East Green Initiative (MGI), a regional effort to mitigate the impact of climate change on the region (Kingdom of Saudi Arabia, n.d.). Harmonizing sustainable finance taxonomy and collaborating on environmentally responsible investment standards, reporting, and training at the regional level can facilitate cross-border investments in sustainability projects, reduce greenwashing, mitigate market fragmentation, and enhance regional integration, including within the financial sector.

# Annex 1. Data and Empirical Framework for Assessment of Impact from Acute Physical Risks

This annex describes the methodology used to assess the impact of climate physical risks on bank balance sheets of countries in the ME&CA.

**Time horizon.** 2000 to 2021, annual frequency.

**Baseline specification.** We estimate the following baseline specification:

$$y_{c,t} = \alpha_c + \delta_t + \rho y_{c,t-1} + \beta D_{c,t-1} + \sum_{j=0}^J \gamma_j x_{c,t-j} + \theta z_{c,t-1} + \varepsilon_{c,t}, \quad (A.1)$$

where, for country  $c$ ,  $y_{c,t}$  is the bank performance metric of interest in year  $t$ ,  $\alpha_c$  is a country fixed effect,  $\delta_t$  is a year fixed effect,  $D_{c,t-1}$  is a variable capturing the occurrence of acute climate-related events in year  $t-1$ , and  $x_{c,t-j}$  is the GDP growth rate at time  $t-j$ , and with  $j = 0, 1$ ;  $z_{c,t-1}$  is an index of financial sector development. We assess the impact of climate disasters on a set of bank metrics, including loan loss provisions and the nonperforming loan ratio, capitalization (Tier 1 capital to risk-weighted assets), bank z-scores, and indicators of liquidity (liquid assets to short-term liabilities) and profitability (return-on-assets).

**Identification.** The exogeneity assumption required for the identification of our target coefficient  $\beta$  in Model (A.1), measuring the impact of climate-related events on bank balance sheets characteristics, entails that banking sector performance does not coincidentally affect a country's exposure to climate disasters. We consider this assumption compelling, as banking performance is unlikely to determine climate events at an annual frequency.

**Sample.** Due to limited data availability, estimation is performed on an unbalanced panel comprising a set of 17 ME&CA countries including Armenia, Azerbaijan, Egypt, Georgia, Jordan, Kazakhstan, Kyrgyz Republic, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan in regressions using data from IMF Monetary and Financial Statistics database. In regressions using data from the IMF Financial Soundness Indicators database, the sample is limited to 13 countries: Algeria, Armenia, Georgia, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Pakistan, Saudi Arabia, Tajikistan, United Arab Emirates, and Uzbekistan. Estimation is made using yearly frequencies between 2000 and 2021.

**Data sources on climate disasters.** We source data on acute climate events from the EM-DAT database. Specifically, we consider the following climate-related events: droughts, extreme temperatures, floods, landslides, and storms. Two issues should be accounted for when considering floods in the ME&CA region. First, in countries exposed to the risk of floods, these events often occur with relatively limited domestic regional variation and high frequency (this is typically the case for seasonal riverine floods). Second, the events often cause limited damage (in the EM-DAT database, the median flood damage is reported to be null, even if this could be in part due to poor data quality). To account for these issues, we restrict our analysis to larger events, defined as those entailing an economic damage equal or above the 75th percentile of the distribution of flood-related damages in ME&CA countries. Disasters not directly related to climate are excluded from the analysis. Earthquakes and dry landslides, which are recorded in the EM-DAT database but not related to climate change, are excluded from the analysis.

**Other data sources.** Bank balance sheet data are obtained from the Financial Soundness Indicators produced by the IMF. Credit loss provisions are sourced from the IMF Monetary and Financial Statistics database. Credit loss provisions are liabilities for other depository corporations, consisting of all resident

financial corporations (except the central bank) and quasi-corporations that are mainly engaged in financial intermediation and that issue liabilities included in the national definition of broad money (for example, commercial banks, merchant and saving banks, and credit unions). Bank z-scores are taken from the Financial Development and Structure database of the World Bank. Other macroeconomic controls, including GDP growth, are sourced from the IMF's World Economic Outlook database, and financial sector development is measured by the IMF Financial Development index.

## Methodology and Detailed Results on Assessing Impact of Climate Disasters on ME&CA Banks

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We begin by investigating the impact of climate disasters on bank loan loss provisions. Regressions results corresponding to the baseline Equation (A.1) are reported in Annex Table 1.1. Some climate-related disasters are associated with an increase in banks' loan loss provisioning. Droughts, extreme temperature events, and floods are positively associated with an increase in bank loan loss provisions in the year following climate event in both the MENAP and CCA regions. Other climate-related disasters (landslides and storms) appear to have no statistically significant impacts on bank provisioning. Quantitatively, the occurrence of a drought in a given year increases bank credit provisions of about 21 percent in the ME&CA region as a whole, with but with large differences in between the two subregions (MENAP and CCA), while the occurrence of an extreme temperature event increases bank provisioning by about 16 percent. Floods, on average, increase the bank credit provisions by about 10 percent on average for the ME&CA region.

While there are sizable differences in the magnitude of the estimated impacts of some climate disasters across the two regions, the interpretation of such cross-regional differences is challenging, as the simple identification of a climate-related disaster does not provide an assessment of its magnitude in terms of economic impacts. To improve the comparability of the estimated impact of disasters on provisions, Annex Table 1.2 reports standardized coefficients for corresponding estimates presented in Annex Table 1.1. A one standard deviation increase in droughts has a significantly higher (over two-fold) impact on provisions in CCA with respect to MENAP. This result could be due to a number of factors, including cross-regional differences in adaptive measures, insurance sector penetration, differences in government bailout policies, and possible differences in the severity of these events across the two regions or in their implications for the economy.

With the purpose of increasing estimation efficiency, we proceed with the construction of a new dummy variable that measures the occurrence of a generic climate hazard that is relevant for the ME&CA region. This variable takes the value of 1 for each given year in which a drought, an extreme weather event, a drought or a flood takes place in a given year, and zero otherwise. Regression results for corresponding estimations of Model (A.1) are reported in the first column of Annex Table 1.3. Results suggest that climate disasters have a positive and significant impact on bank credit loss provisions in the ME&CA region. In the year following a disaster, bank loan loss provisions increase on average by 19 percent. This result provides an assessment of the marginal impact of a generic climate-related disaster on the year-over-year percentage change in credit loss provisions. To have an indication of the corresponding impact in US dollars we regress the dollar value (at constant 2021 prices) of credit loss provisions on climate disasters. Results are reported in the second column of Annex Table 1.3. Estimates point to an average impact on bank credit provision of around \$250 million for each disaster year. Considering that the EM-DAT database counts a total of 146 relevant climate event years (including droughts, extreme weather events, and floods) in ME&CA countries, over the period 1980 to 2021, this result suggests that climate-related disasters could have had a cost of around \$37 billion since 1980 for banks in the region.

**Annex Table 1.1. Impact of Disasters on Bank Credit Provision, by Disaster Type**

	(1) Loan Loss Provisions	(2) Loan Loss Provisions	(3) Loan Loss Provisions
L.Loan loss provisions	0.236** (0.051)	0.227** (0.070)	0.221** (0.090)
L.Drought	20.773** (7.442)	11.020** (3.746)	43.294** (11.892)
L.Extreme temperature	16.437** (6.596)	14.821+ (8.534)	16.268* (7.758)
L.Flood	9.702* (4.779)	4.431 (4.854)	24.555 (21.875)
L.Landslide	-1.403 (6.323)	8.264 (5.452)	-3.958 (11.554)
L.Storm	0.455 (3.331)	0.013 (2.755)	-1.71 (8.285)
Real GDP growth	0.771 (0.515)	-0.145 (0.331)	1.172 (0.769)
L.Real GDP growth	-0.579 (0.398)	-0.663* (0.338)	-0.857 (0.615)
L.Financial development index	3.302 (43.833)	31.768 (51.752)	-55.956 (93.794)
Area	MENAP&CCA	MENAP	CCA
Year FE	Yes	Yes	Yes
Adjusted $R^2$	0.164	0.076	0.267
Observations	238	129	109

Source: IMF staff calculations.

Note: The dependent variable is provisions for loan losses, percent change from the preceding year. The country sample for the unrestricted (first) model comprises Armenia, Azerbaijan, Egypt, Georgia, Jordan, Kazakhstan, Kyrgyz Republic, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan. MENAP includes Egypt, Jordan, Kazakhstan, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tunisia, and United Arab Emirates. CCA includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan. Robust standard errors in parentheses. +  $p < 0.11$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ . CCA = Caucasus and Central Asia; FE = fixed effects; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

A question related to the US dollar value of bank credit losses linked to climate disasters concerns the pass-through of total disaster damages to bank balance sheets. Answering this question would require data on the dollar value of damages associated with every severe climate event. In the EM-DAT database, information about the damage loss linked to each disaster is sparse and incomplete. Cognizant of this limitation, we estimate the marginal impact on \$1 in climate disaster damages on bank credit losses in US dollars. Estimation results are reported in Annex Table 1.4 and suggest that a \$1 loss due to a climate event (extreme temperatures, drought, or flood) may generate about \$0.23 in bank credit losses. This result suggests a relatively high pass-through of disaster damages to bank credit losses, possibly reflecting limited insurance market penetration in ME&CA countries as well as limited government disaster relief plans, even if in some cases (most recently in the aftermath of the 2022 floods in Pakistan) financial assistance can come via international relief initiatives.

**Annex Table 1.2. Impact of Disasters on Bank Loan Provisions, Standardized Coefficients**

	(1) Loan Loss Provisions	(2) Loan Loss Provisions	(3) Loan Loss Provisions
L.Drought	0.946**	0.674**	1.652**
L.Extreme temperature	0.749**	0.907*	0.620*
L.Flood	0.442*	0.271	0.937
L.Landslide	-0.063	0.506	-0.151
L.Storm	0.021	0.001	-0.065
Area	MENA&CCA	MENAP	CCA

Source: IMF staff calculations.

Note: The dependent variable is provisions for loan losses, percent change from the preceding year. The country sample for the unrestricted (first) model comprises Armenia, Azerbaijan, Egypt, Georgia, Jordan, Kazakhstan, Kyrgyz Republic, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan. MENAP includes Egypt, Jordan, Kazakhstan, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tunisia, and United Arab Emirates. CCA includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ . CCA = Caucasus and Central Asia; MENAP = Middle East, North Africa, Afghanistan, and Pakistan.

**Annex Table 1.3. Impact of Disasters on Bank Loan Provisions, Single Disaster Dummy**

	(1) Loan Loss Provisions	(2) Loan Loss Provisions (2021 US dollars)
Lagged dependent variable	0.241** (0.049)	0.224** (0.076)
L.Climate disaster	19.466** (6.226)	256.338** (101.981)
Real GDP growth	0.795 (0.535)	-5.461 (6.032)
L.Real GDP growth	-0.583 (0.382)	-9.281* (4.971)
L.Financial development index	-0.701 (41.775)	1408.179 (978.194)
Area	ME&CA	ME&CA
Year FE	Yes	Yes
Adjusted $R^2$	0.182	0.043
Observations	238	238

Source: IMF staff calculations.

Note: The dependent variable is provisions for loan losses, percent change from the preceding year. The country sample for the unrestricted (first) model comprises Armenia, Azerbaijan, Egypt, Georgia, Jordan, Kazakhstan, Kyrgyz Republic, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ . FE = fixed effects; ME&CA = Middle East and Central Asia.

**Annex Table 1.4. Pass-through of Disaster Damage on Bank Loan Provisions, in US dollars**

	(1) Loan Loss Provisions (2021 US dollars)
Lagged dependent variable	0.257** (0.064)
L. Climate disaster losses (USD)	0.230** (0.073)
Real GDP growth	-19.722** (9.002)
L.Real GDP growth	-9.275 (5.499)
L.Financial development index, IMF	872.051 (713.420)
Observations	223
Area	ME&CA
Year FE	Yes
Adjusted R <sup>2</sup>	0.098

Source: IMF staff calculations.

Note: The dependent variable is provisions for loan losses, percent change from the preceding year. The country sample for the unrestricted (first) model comprises Algeria, Armenia, Egypt, Georgia, Jordan, Kazakhstan, Kyrgyz Republic, Mauritania, Morocco, Oman, Pakistan, Qatar, Syria, Tajikistan, Tunisia, United Arab Emirates, and Uzbekistan. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ . FE = fixed effects; ME&CA = Middle East and Central Asia.

In Annex Table 1.5, we report the impact of climate disasters on key bank performance and capital adequacy ratios. The first column reports the impact of climate disasters on credit quality (bank nonperforming loans to total gross loans), with the results suggesting that following a disaster year, the nonperforming loan ratio of banks in the region increase by about 1.4 percentage points.

Rising bank loan loss provisions following a climate disaster are likely to affect overall profitability of affected institutions. In column 2 of Annex Table 1.5, a measure of bank profitability (return on assets) is regressed on the disaster variable, with the results suggesting that climate-related disasters are associated with a deterioration in bank profitability. Quantitatively, during a disaster year, ME&CA banks return on assets declines by about 0.6 percentage point on average.

Climate disasters that create large reconstruction needs could increase customer deposit withdrawals from banks, adversely affecting bank liquidity. In the third column of Annex Table 1.5, the baseline specification is used to estimate the impact of climate disasters on bank liquidity, measured as the ratio of banks' liquid assets to short-term liabilities. Regression results suggest no statistically significant impact of natural disasters on bank liquidity ratios.

If banks suffer significant losses because of climate-related events, this could adversely affect their capitalization. In the fourth column of Annex Table 1.5, we consider the impact of climate events on the capital adequacy ratio (regulatory Tier 1 capital to risk-weighted assets) of financial institutions in 13 MENA and CCA countries. The results provide tentative evidence (the statistical significance of this results is limited) that climate events impact negatively on capital adequacy, with a decline in capital adequacy of around 0.8 percentage point in the year following a disaster.

**Annex Table 1.5. Impact of Disasters on Bank Ratios**

	(1) Nonperforming Loans to Total Gross Loans	(2) Return on Assets, (ROA)	(3) Liquid Assets to Short Term Liabilities	(4) Tier 1 Capital to Risk-Weighted Assets	(5) Z-score
L.Dependent variable	0.763** (0.047)	0.421** (0.168)	0.307** (0.053)	0.437** (0.042)	0.745** (0.058)
L.Disaster (dummy)	1.434* (0.660)	-0.619** (0.265)	41.63 (30.658)	-0.810* (0.526)	-0.774 (0.684)
Real GDP growth	-0.04 (0.075)	-0.072 (0.063)	0.702 (1.170)	-0.046 (0.056)	0.027 (0.047)
L.Real GDP growth	-0.059 (0.111)	0.023 (0.041)	1.861 (2.149)	0.061 (0.099)	0.036 (0.050)
L.Financial development	4.679 (3.374)	6.769** (2.753)	-171.105* (90.838)	-7.571** (2.297)	3.013 (4.308)
Area	ME&CA	ME&CA	ME&CA	ME&CA	ME&CA
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.719	0.294	0.212	0.267	0.64
Observations	145	146	145	149	234

Source: IMF staff calculations.

Note: The dependent variable is Tier 1 capital to risk-weighted assets, percent (first model); liquid assets to short-term liabilities, percent (second model); and return on assets, percent (third model). Country sample: Armenia, Azerbaijan, Georgia, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Pakistan, Saudi Arabia, Tajikistan, United Arab Emirates, and Uzbekistan. Robust standard errors in parentheses. +  $p < 0.15$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ . FE = fixed effects; ME&CA = Middle East and Central Asia.

The z-score is the ratio of return-on-assets plus capital-asset-ratio to the standard deviation of return on assets, and it is a widely used measure of the distance to default. Specifically, the z-score indicates the number of standard deviations that a bank's return on assets must drop below its expected value before equity is depleted and a bank becomes insolvent. In the last column of Annex Table 1.5, we regress the z-score on the disaster dummy, with the results suggesting no statistically significant impact of disasters on bank z-scores.



## Annex 2. Data and Empirical Framework for Assessment of Impact from Transition Risks

This annex describes the methodology used to assess the impact of climate transition risks on bank balance sheets of countries in the ME&CA.

**Assumptions.** We proxy the costs of climate transition by an increase in the effective carbon price, while recognizing that mitigation policies to support transition to a low-carbon economy can take different forms (for example, removal of subsidies to renewable energy production, caps on fossil-fuel-based power generation, green investment, etc.). However, the representation of transition risk as an increase in the carbon price is a convenient, powerful, and relatively tractable assumption that mitigates modeling challenges of decarbonization scenarios. Finally, regardless of political challenges in implementing domestic carbon taxes across countries, additional costs to firms may come through the Carbon Border Adjustment Mechanism for energy-intensive exports of the region.

**Question for analysis.** We aim to answer the following question: How does an increase in the domestic effective carbon price impact banks' credit exposures, such as loans, by affecting firms' operating costs?

**Methodology.** To estimate transition risks to financial stability, a firm-level balance sheet approach is employed.<sup>38</sup> We aim to estimate the negative impact of applying a cost on carbon emissions on firms' ability to service their debt, thereby affecting their lenders' financial health and, eventually, the stability of the financial sector.

**Data sources and coverage.** We rely on firm-level data drawn from the S&P Capital IQ (Compustat) database using the latest period available (2022). We perform an extensive series of cleaning and filtering exercises to the initial data in order to derive a comprehensive data set of much higher quality than the raw Capital IQ data. The final sample includes more than 780 publicly listed nonfinancial firms in 2022 that have information available for a wide range of balance sheet and income statement variables. The micro-level data set covers firms from nine countries and spans a variety of industries. Our banking-system-level data includes national banking systems' outstanding loans to each sector. The source for this data is the national central bank's statistical bulletins (some available on Haver Analytics).

**Empirical analysis.** Our empirical analysis follows the framework of Sever and Perez-Archila (2021) and is conducted at the sectoral level. First, we estimate carbon dioxide emission intensities across countries at the sector level using International Energy Agency data which relies on a specific set of sector classification. Second, we combine sectoral emission intensities with firm-level output data to come up with firm-level emissions. Third, we estimate the additional burden imposed on firms operating expenses by applying a carbon tax (\$75/ton of carbon dioxide)<sup>39</sup> to estimated firm-level emissions under a "no-pass-through" assumption.<sup>40</sup> We then calculate the share of financially stressed firms in each sector proxied by the ICR.<sup>41</sup>

<sup>38</sup> The main challenge for evaluating the transition risks is that those risks are complex, multifaceted, and, in turn, hard to model with feedback loops and second-round effects (Sever and Perez-Archila 2021). Thus, to keep the analysis tractable, several simplifying assumptions are made (such as no-pass-through on firms' side and a static stress test).

<sup>39</sup> We assume an increase of the carbon price to an average of \$75/ton of carbon dioxide equivalent in line with the proposal for an international carbon price floor that would be needed by 2030 to keep warming below 2 degrees Celsius and supported by IMF (2019a).

<sup>40</sup> Anderson and others (2022) estimate that the current level of the effective carbon rate in MENAP is estimated at about \$-11 per metric ton of carbon dioxide, reflecting the prevalence of fossil fuel subsidies, the level of which is lower in the CCA, where the effective carbon rate is estimated at about \$11 per metric ton of carbon dioxide. The effective carbon rate is defined as the net fiscal revenue from domestic fossil fuel consumption—that is revenue from taxation and emission permits net of subsidies—per metric ton of carbon dioxide emissions.

<sup>41</sup> A negative ICR position "firm-at-risk" suggests that the firms' current earnings are insufficient to service its outstanding debt (earnings before interest and taxes/interest expense).

We also use an alternative scenario of \$30/ton of carbon dioxide, which is the effective carbon tax rate needed (through taxation of fossil fuels or phasing out subsidies) to reach NDC targets without any additional renewable energy investments (Anderson and others 2022). Finally, we combine this information with the banking-system-level exposures to each sector to quantify the transition risk imposed on the banking system by each sector, that is, to estimate bank loans at risk of becoming nonperforming due to the increase in the carbon tax.

**Caveats in quantifying banks' transition risks.** Although there have been growing efforts to quantify risk exposures and assess the corresponding potential losses arising from transition risks using top-down stress tests (for example, Bank of England, Banque de France, European Central Bank, and the IMF), conducting climate change stress tests for banks comes with several challenges. Climate risk assessments are currently limited by a lack of granular data to estimate the relationship between climate risk events, financial system, and individual institutions. This is particularly the case for the ME&CA region. Second, simplifying assumptions, such as "static" balance sheet assumption and the lack of second-round effects and feedback loops, still need to be made. Finally, a comprehensive stress testing scenario would ideally reflect both physical and transition risks. Given the early stages, there is lack of established common practices for banks' climate risk stress testing across countries, leading to ad hoc approaches, that may fail to tailor to uncover unique risks in each country's context.

# Annex 3. The Structure of the Insurance and Reinsurance Sectors, and the Role of the Reinsurance Sector in Mitigating Climate Risks in the ME&CA Region

## Structure and the Developments in the Insurance Sector in the ME&CA Region

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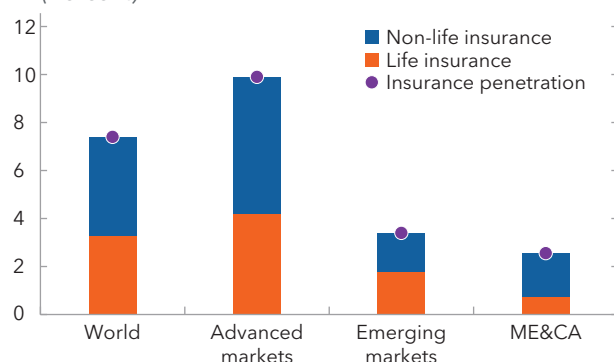
The insurance market in the ME&CA region is small and its growth stagnant. In the ME&CA region, insurance penetration, measured as the ratio of insurance premiums to GDP, was estimated at 2.4 percent in 2020, lower than in advanced economies (9.9 percent) and emerging markets (3.4 percent) averages (Annex Figure 3.1, panel 1). However, insurance penetration rates vary significantly across the region, ranging from 0.7 percent in Egypt and Kazakhstan to more than 3 percent in Morocco and the United Arab Emirates. At the same time, insurance density (insurance premiums per capita), estimated at about \$102 in 2020, remains significantly below the average estimated for advanced markets (\$4,695) and global average (\$809). As is the case with insurance penetration, there is considerable variation in insurance density across countries, ranging from \$10 in Pakistan to \$1,291 in the United Arab Emirates (Annex Figure 3.1, panel 2). The low insurance penetration and density rates are consistent with the nascent stage of development of the insurance sector and provide opportunities for rapid growth in the sector.

Iran, Saudi Arabia, and the United Arab Emirates are the largest insurance markets in the ME&CA region. During the period 2015–20, the proportion of insurance premiums of these countries to total insurance premiums in the region averaged 18 percent, 17 percent, and 16 percent, respectively (Annex Figure 3.1, panel 3). The large market share in Saudi Arabia and the United Arab Emirates in the GCC region reflects, in part, the introduction of mandatory health and motor coverage, ongoing market consolidation, as well as reforms aimed at strengthening the regulatory environment. This, together with increased infrastructural development in the last decade, have contributed to insurance premium growth in the two countries. The Iran insurance market is mainly driven by increased government participation in the insurance market, including through measures to enforce mandatory health coverage, as well as through efforts to improve the awareness of insurance services by the population. In addition to these measures, Iran's government introduced a mandatory natural disaster insurance fund, which followed increased occurrence of natural disasters leading to increased insurance premiums.

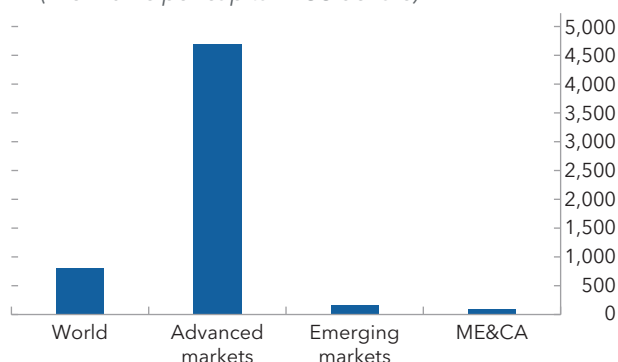
The non-life insurance segment constitutes about 80 percent of total insurance premiums written in the ME&CA region. Non-life insurance premiums grew by 8 percent to \$55 billion between 2017 and 2020, reflecting developments in the health, motor, and property insurance (Swiss Re 2021). These three segments together represent more than 80 percent of total non-life insurance premiums in the ME&CA region (Annex Figure 3.1, panel 4). In addition to the mandatory motor insurance across several markets in the region, most countries have introduced compulsory health insurance coverage, contributing to growth in these segments. In terms of penetration however, as shown in Annex Figure 3.1, panel 1, non-life insurance penetration remains low at only 1.8 percent compared to 5.7 percent in advanced economies, reflecting the nascent development stage of the sector. Property insurance constitutes a considerable coverage of households and other property owners, who are easily exposed to property damage risks due to fires and climatic shocks, leading to higher premiums. Whereas motor and health insurance are mostly covered by local

### Annex Figure 3.1. ME&CA's Insurance Sector

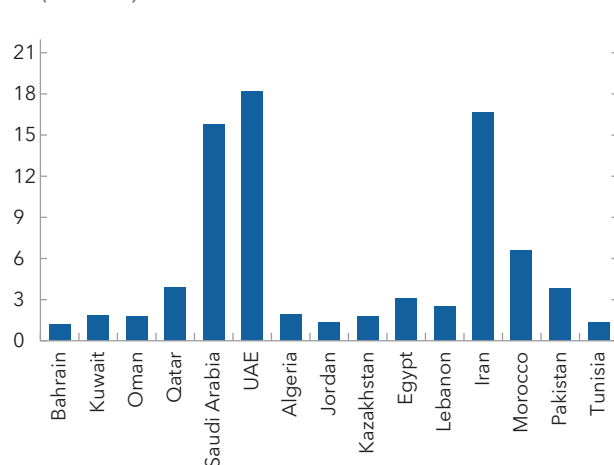
1. Insurance Penetration in ME&CA, 2020  
(Percent)



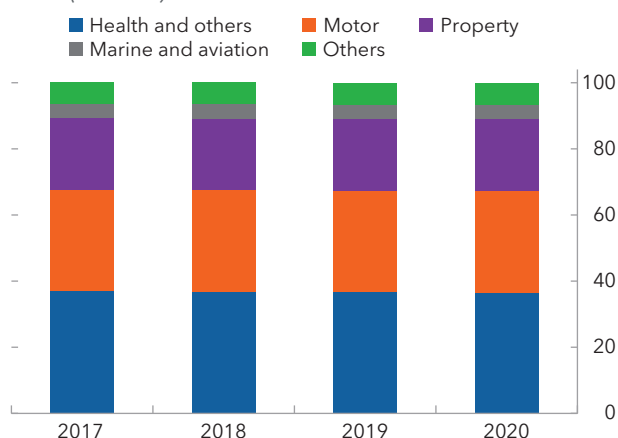
2. Insurance Density in ME&CA, 2020  
(Premiums per capita in US dollars)



3. Insurance Market Shares in ME&CA, 2015-20  
(Percent)



4. Composition of Non-life Insurance Premiums in Selected Countries<sup>1</sup> in ME&CA, 2017-20  
(Percent)



Sources: Swiss Re Institute 2021; and IMF staff estimates.

Note: ME&CA = Middle East and Central Asia; UAE = United Arab Emirates.

<sup>1</sup>Countries include Algeria, Egypt, Morocco, and United Arab Emirates.

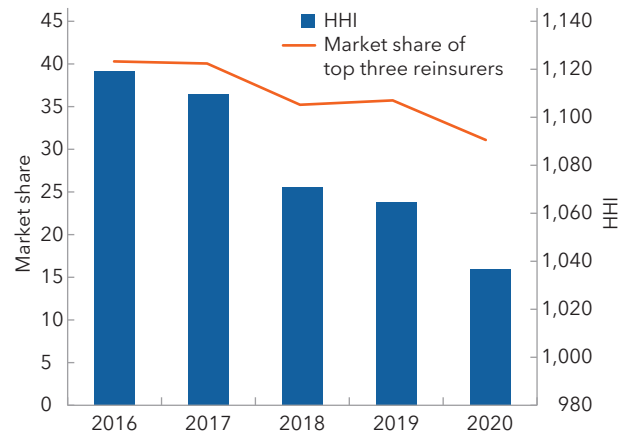
insurers, property insurance is segmented along local insurers and international re(insurers) (Marsh 2021). Companies requiring large insurance capacity for property-related risks such as those related to climatic shocks rely on reinsurers to absorb the excess risks.

## Structure and the Developments in the Reinsurance Sector in the ME&CA Region

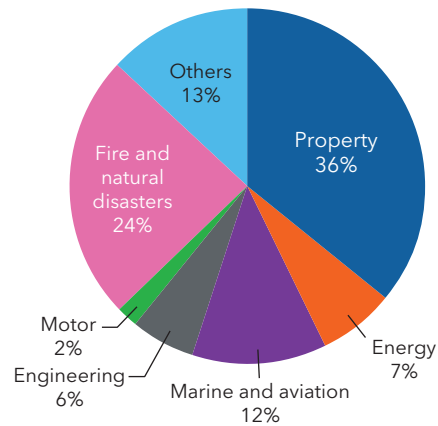
The reinsurance market in the ME&CA region remains small and constitutes mainly single market players. In 2020, the gross reinsurance premiums for the top 10 reinsurers in the region constituted only \$2.2 billion of the \$220.2 billion total gross reinsurance premiums for the top 10 reinsurers globally. The region's reinsurance market faces several challenges, including highly competitive pricing, significant losses (including losses due to natural catastrophes), and a less developed primary insurance market. These have contributed to low returns on investment, averaging 4.9 percent between 2018 and 2020. In addition, compared to global averages, the market faces high reinsurance costs and commissions, reflected in high returns on

### Annex Figure 3.2. Market Share and Reinsurance Turnover in MENA Region

1. Market Share of Top Three Reinsurers and HHI, 2016-20 (Percent)



2. Reinsurance Market Turnover Non-Life Premiums by Business Lines, 2020 (Millions of US dollars)



Source: Atlas Magazine: Insurance and Reinsurance News 2022.

Note: HHI = Herfindahl-Hirschman Index; MENA = Middle East and North Africa.

equity. In 2020, the region's returns on equity averaged 7.8 percent, above a global average of 2.5 percent. These challenges have made the market less attractive and more costly for most local and regional reinsurers, leading to the withdrawal of several market players in recent periods.

Despite these challenges, the region's dependency on the reinsurance market is increasing. With a focus on motor and medical risks, the primary insurance market is constrained in terms of product diversification and underwriting capacity for high-value risks. At the same time, the withdrawal of several market players has not curtailed the appetite to participate in the region's reinsurance market, with a steady increase of international reinsurers, as well as African and Asian regional players, for diversification of risk. In the GCC region, for instance, the cession rate, which measures the ratio of reinsurance premiums to total gross written premiums, averaged around 40 percent in 2020 and is considerably above the global rate of 5 percent. The cession rates depict a greater level of variation across countries in the region ranging from low rates in Oman (15 percent) and Saudi Arabia (24 percent), to much higher in Bahrain (53 percent) and the United Arab Emirates (62 percent).

The reinsurance market has become increasingly more competitive, reflecting the availability of reinsurance capacity. In the MENA region, while the Herfindahl-Hirschman Index averaged 1,080 during 2016-20, the market share of the top three reinsurance companies has been declining since 2016, reflecting increased competition in the market (Annex Figure 3.2). The primary insurance market could leverage the available capacity in the region's reinsurance market, to diversify its insurance portfolio especially in high-value risk business lines such as property and natural catastrophe, which are most underwritten by the reinsurers in region (Annex Figure 3.2). However, the recent hardening market conditions in the global reinsurance markets may reverse these trends in the region, and this will require careful management of underwriting risks to ensure that these conditions do not erode the already thin underwriting margins.

## The Role of the Reinsurance Sector in Mitigating Climate Risks in the ME&CA Region

The reinsurance market could be leveraged to mitigate climate-related risks. The region's reinsurance market enjoys abundant capacity and presents important growth and investment opportunities especially for the primary insurance market. The primary insurance market could leverage the excess capacity in the region's reinsurance market, to diversify its insurance portfolio especially in high-value risk business lines such as property and natural catastrophe. There are specific ways through which the primary insurance market could benefit from the reinsurance market in mitigating climate risks:

- *Diversification of the insurance portfolio:* Reinsurance markets provide a soft landing for primary insurers to venture into new business lines in the insurance market, thus promoting diversification. This could be achieved through increased risk transfer to the reinsurer by the new entrants and relying on the reinsurers' underwriting experience to expand their portfolio. A more diversified portfolio requires less capital to cover expected losses than a more concentrated portfolio (OECD 2018). Thus, reinsurance markets allow for more competition in the market to break a rather concentrated primary insurance market. In the case of the ME&CA region, there is a negative correlation of 0.3 between the share of non-life gross written premium accounted for by the largest five insurers and their corresponding cession rates. Although weak, the negative correlation implies that the need for reinsurance increases as competition in the insurance market increases and decreases with high market concentration. Thus, smaller primary insurers such as those in the ME&CA region are more likely to benefit from diversification that comes along with risk transfer to reinsurance markets.
- *Increase in underwriting capacity:* Reinsurance markets increase the capacity of primary insurance markets to underwrite new business lines. With the primary market in the ME&CA region focusing mainly on traditional business lines (that is, motor and health), requiring less underwriting capacity, the reinsurance market presents growth opportunities by widening the insurance portfolio to include higher-value risks with higher capital requirements. Using available data for insurance and reinsurance companies in the MENA region, we find a positive correlation of 0.75 between the insurance cession ratio and the ratio of gross written premiums to shareholder equity, implying that insurance firms can leverage their reliance on reinsurance markets to expand their underwriting capacity into more business lines.
- *Managing high-value climate-related catastrophe risks:* Primary insurance markets could benefit from the capacity of reinsurance markets to diversify and manage risks across geographies, peril, and lines of business (OECD 2018). In the event of high exposure to catastrophic events such as floods and storms, among other climate-related risks, insurance markets in the region could take advantage of the reinsurance market to acquire the necessary expertise to manage such events and to mobilize the high capital requirements to cover volatilities in potential claims. In addition, through the possibility of diversification of concentrated risks and transferring part of the risk into the global market, reinsurance markets are beneficial in smoothing economic disruptions in the aftermath of a natural disaster (Cummins and Mahul 2009; NAIC 2022).

## Annex 4. Investing for a Greener Economy: The Special Role of SWFs in Scaling Up Green Finance in the ME&CA Region

SWF participation in green finance remains very low—with most estimates suggesting less than 1 percent of total assets under management, including green debt funds, renewable energy projects, and green infrastructure. Despite the region's gradual improvement in governance, sustainability, and resilience scores (driven mainly by the Qatar Investment Authority [Qatar], Mubadala [Abu Dhabi], and the Public Investment Fund [Saudi Arabia]), all SWFs in the region score medium or low on the 2022 SWF governance, sustainability, and resilience scorecard, which assesses the world's 100 largest state-owned funds. Some of the regional SWFs, including the Abu Dhabi Investment Authority, Mubadala, and the Public Investment Fund have pledged net zero goals. Nevertheless, only four SWFs in the region have a dedicated team for responsible investing, though none produce a publicly available annual ESG report.

The low SWF participation in green finance is explained in part by a lack of regulatory standards and data quality. Other obstacles, which are similar for private investors, include (1) perceived scarcity of green investment opportunities, (2) perceived low financial returns, and (3) a lack of clarity on government green finance policies. The lack of reliable and comparable data makes it difficult to quantify the impact of SWFs' sustainable investment strategies and fuels concerns about greenwashing, creating reputational risks when implementing and reporting on ESG.

SWFs are seeking to enhance their involvement in green finance. This includes through the Task Force on Climate-related Financial Disclosures and the One Planet Sovereign Wealth Fund, and a working group of the six largest SWFs developing and publishing a framework to support the alignment of large, long-term, and diversified SWF asset pools in line with the goals of the Paris Agreement (IFSWF 2017). The One Planet Sovereign Wealth Fund Network now includes 47 members (19 SWF members, of which 7 from ME&CA, 18 asset managers members, and 10 private equity funds members) with over \$37 trillion in assets under management and ownership.<sup>42</sup> Alliances such as the One Planet Sovereign Wealth Fund Network are seen as important ways for sovereign investors to maximize their influence over large corporations to employ more sustainable practices, as several large investors coming together under a single umbrella organization are much more likely to effect change.

The extent to which SWFs will be able to actively engage in green investments will depend on their risk appetite (savings funds would have higher risk appetite versus stabilization funds), overall objectives, and internal capacities. There are significant opportunities for SWFs to scale up investments in green projects (water, energy, infrastructure, sustainable cities, etc.) through targeted funds or structured investment opportunities and across the asset class spectrum, including PPPs, debt, and equity.<sup>43,44</sup> Given efforts aimed

<sup>42</sup> Participating SWFs of the region are the Abu Dhabi Investment Authority, the Kuwait Investment Authority, the Public Investment Fund (Saudi Arabia), the Qatar Investment Authority—all founding members—as well as Mubadala (United Arab Emirates), National Investment Corporation of the National Bank of Kazakhstan, and the Sovereign Fund of Egypt.

<sup>43</sup> In cases where project ticket sizes are too small for SWFs, innovative bundling mechanisms that aggregate smaller projects, such as the United Kingdom's Pension Infrastructure Platform, could be explored (Braunstein 2016).

<sup>44</sup> The SWF green investment/finance strategy should be closely coordinated with the government green strategy and formal budget process to avoid undermining fiscal rules and increased transparency and accountability. This can be achieved by developing a system of checks and balances to ensure solid management, stating climate-related goals in the institution's mandate, hiring qualified staff, and establishing clear rules and modalities that would govern allocation decisions (Gelb and others 2014). Transparency requirements, adequate government capacities, and a balanced growth strategy all should be taken into consideration.

at prudent fiscal policy in many ME&CA (in particular oil-exporting) countries, much of the investments required to achieve a smooth energy transition will need deeper exposure into private markets, in capital markets that are relatively underdeveloped, and where risks are potentially greater. For example:

1. *Investments in green listed and private companies:* Some SWFs have developed strategies to invest in green assets. For example, Mubadala supports many wind and solar projects, including in developing countries, and invests in green hydrogen. Morocco's Ithmar Capital collaborates with the World Bank to invest in clean energy, low carbon transport, and water projects in Africa through the recently launched Green Growth Infrastructure Africa Facility.
2. *Policies and regulations for green investment:* Some SWFs have introduced specific investment policies and regulations to address climate risks. For example, Mubadala established a standalone Responsible Investing Unit and published its Responsible Investing Policy, articulating its approach to integrating green finance principles and considerations into its investment and asset management decisions. The One Planet Sovereign Wealth Fund Working Group has also committed to incorporating sustainable projects into their investment decisions.
3. *Portfolio decarbonization:* SWFs are pioneering decarbonization efforts of their active and passive portfolios. For example, the National Investment Corporation of the National Bank of Kazakhstan has initiated a revision of its investment guidelines for its private equity portfolio, aiming to limit holdings in carbon-heavy industries such as coal mining and crude oil production. These efforts provide important signals to policymakers and reduce SWFs' exposure to potentially declining industries and stranded assets. In a nutshell, SWFs can take two approaches: (1) they can stay and engage with companies to pressure them to reallocate their own investments into low-carbon technologies, or (2) they can divest.

Overall, regional SWFs continue to favor more established opportunities, with investments in renewables booming in 2022. Renewable energy remains the most popular investment sectors, with 70 percent of One Planet Sovereign Wealth Fund survey respondents saying it was the most attractive climate-related sector. Equally, private equity, real assets, and listed equity continue to be the most usual asset classes for SWFs to pursue targeted portfolio construction for green purposes. Recently, ME&CA SWFs have significantly increased their alignment with the sustainable finance framework, increased their engagement with investee companies and asset managers, and deepened the integration of climate-related risks and opportunities into investment decisions to improve resilience (Annex Table 4.1).

However, given the needs, and the leading role that they can potentially play, ME&CA SWFs could go beyond their current plans to establish sustainable finance frameworks. This should be supported by directing their significant resources toward regional green finance and scaling up investments in renewables and low carbon industries, while managing exposure to fossil fuel investments that may be at risk in the context of global energy transition.

Finally, an important development is the potential investment reach of SWFs to other countries in the region, including to economies which are more limited in their capacity to finance energy transition. Recently for example, the Public Investment Fund and Mubadala have committed to green investment in Egypt, while Ithmar Capital is involved in several green investments in Africa, and ADQ is supporting green projects in Oman. The Middle East Green Initiative is also seeking to attract funds to the region (Vision 2030, n.d.). This could constitute an important avenue to address financing needs in some of the most economically vulnerable countries in the region, in particular (for example, Egypt, Pakistan, and Tunisia).



**Annex Table 4.1. SWFs Green Financing in ME&CA**

Egypt	<p>TSFE was established in 2018 with an aim to “create sustainable value for future generations” and follows an ESG framework for responsible investing, and is a member of the OPSWF.</p> <p>In line with Egypt’s 2050 National Climate Change Strategy and its ambition to turn the Suez Canal Economic Zone into a hub for green hydrogen and ammonia, TSFE signed memorandums of understanding worth \$40 billion in planned green hydrogen investments and plans to invest \$225 million of its own capital in green hydrogen over 2022-23. TSFE is also working to crowd fund investment in renewable energy, green hydrogen, green ammonia, and desalination.</p>
Kazakhstan	<p>The NIC NBK has initiated a revision of the investment guidelines for its private equity portfolio, aiming at limiting holdings in carbon heavy industries such as coal mining and crude oil production.</p> <p>NIC NBK, as member of the OPSWF Initiative, pledged its support for the recommendations of the TCFD and encouraged its investees to align with the OPSWF Framework and adopt the international standards for climate-related financial reporting. NIC NBK continues to work with asset managers toward integration of opportunities in transition to a low-emissions economy, and addressing the risks related to climate change across a diverse pool of asset classes. NIC NBK has also initiated the process of Impact and Thematic portfolio development aimed at solving environmental issues.</p>
Kuwait	<p>The KIA, as a member of OPSWF, endorsed and encouraged the adoption of the TCFD and the implementation of ESG investment principles. KIA committed to publishing an internal ESG Risk Report, which will be presented to its stakeholders on a quarterly basis.</p> <p>KIA has engaged with its asset managers, private equity managers, companies, and other SWFs to encourage the adoption of TCFD recommendations in their climate reporting. Additionally, KIA engages directly with companies on their efforts to develop climate-friendly products and asking the companies KIA invests in directly to seek out a favorable MSCI environmental rating score.</p>
Morocco	<p>The Mohammed VI Fund has a green component and seeks to embed ESG criteria into its investment process and support Paris Agreement-compliant projects. The fund has developed an ESG policy document, a climate finance strategy, and a set of tools to implement ESG criteria and assess climate risk.</p> <p>Ithmar Capital has been involved in several green investments, such as the creation of the Green Growth Infrastructure Facility for Africa, the first pan-African fund dedicated to green investment in the continent. Ithmar Capital also signed a deal with three Gulf sovereign funds and nine African peers to promote investment on the continent, especially in green sectors.</p>
Oman	<p>The OIA is working on an ESG framework which could allow the fund to attract more investors who are interested in sustainable and responsible investments. Some of the OIA’s subsidiaries, such as Oman Infrastructure Fund (Rakiza), have also committed to ESG principles in their investment decisions. Rakiza invests in infrastructure projects that have positive social and environmental impacts, such as renewable energy, water and waste management, and transportation.</p> <p>OIA has been pursuing various investments in green industries, including in hydrogen, solar, and wind projects in partnership with ADQ, worth over \$8.16 billion and green aluminum and steel projects with ADQ and other international partners;</p> <p>OIA also approved an exit plan for its wholly owned energy and petrochemical subsidiary OQ Group.</p>
Qatar	<p>In January 2020, the QIA announced it will stop new investments in fossil fuels. In 2021, QIA has embedded ESG in its operations in four ways: (1) by building an investment/ESG policy to reflect climate considerations, (2) by reviewing climate-related benchmarks, (3) by developing employee educational campaigns, and (4) by using climate-related criteria in its investment process. By 2022, QIA appointed ESG-focused personnel and pledged its support for TCFD policies.</p>

Annex Table 4.1. Continued

	<p>QIA Industrials support its portfolio companies' green transition to reduce their carbon footprint and contribute to their aim of achieving net zero. QIA is actively investing in sustainable food and building companies, as well as investing across the value chain in companies and technologies focused on the transition to a clean-tech low-carbon emission future. For example, the percentage of renewables in QIA's infrastructure power generation assets have expanded to 45 percent, and 50 percent and are deemed zero emissions.</p>
Saudi Arabia	<p>The PIF has launched its second Vision Realization Program 2021-25, which outlines the roadmap for driving Saudi Arabia's economic diversification and PIF's continued growth as a global investment powerhouse.</p> <p>In February 2022, PIF published its green finance framework with six broad initiatives, including developing carbon markets and green bond issuance. In September 2022, it issued a landmark \$3 billion green bond. One of the tranches was issued at a 100-year maturity. In February 2023, it issued another green bond for \$5.5 billion. A Post Issuance Impact Report is expected to be presented in the fall of 2023. PIF has become the largest issuer of green bonds in the ME&amp;CA region.</p> <p>PIF in collaboration with the Saudi Tadawul Group has also established the Riyadh Voluntary Exchange Platform for offsets and carbon credits within the Middle East and North Africa Region. Importantly, PIF together with the Ministry of Economy and the capital market regulator has started work on a taxonomy.</p> <p>PIF has been assigned the leading role in developing renewable energy as part of Vision 2030. As a part of PIF's commitment to develop 70 percent of Saudi Arabia's renewable energy by 2030, PIF has invested in a giga-project and is developing hydrogen production and supports the achievement of a circular carbon economy. Beyond ACWA power owned by the PIF and a local leader in renewable energy, a number of other PIF-owned entities are engaged in developing the green economy in Saudi Arabia (and the region).</p> <p>The PIF has also committed \$500 million to fund the TPG Rise Climate Fund, which will focus on growth private equity in five main sectors: clean energy, enabling solutions, agricultural and natural solutions, decarbonized transportation and greening industrials through private equity buyout, and growth equity and structured equity.</p>
United Arab Emirates	<p>Mubadala published its Responsible Investing Policy, articulating its approach to integrating ESG principles and considerations into its investment and asset management decisions and reports detailed information on ESG activity and asset allocation and rolling returns in its bond prospectuses. Mubadala Investment Company established a standalone Responsible Investing Unit. Mubadala is a member of International Forum of Sovereign Wealth Funds initiative and OPSWFs, as well as contributes to the Government of Abu Dhabi's climate objectives through engagements such as the Abu Dhabi Climate Change Task Force.</p> <p>Mubadala's subsidiaries and investee companies (for example, Mudabala Petroleum, Emirates Global Aluminium, and Global Foundries) are also committed to ESG objectives and the development of renewable energy. Mubadala, the Abu Dhabi National Oil Company, and ADQ have also established the Abu Dhabi Hydrogen Alliance to develop low-carbon green and blue hydrogen.</p> <p>Mubadala's Masdar is also investing more than \$30 billion in innovative projects including utility-scale power plants, solar power plants, and individual solar home systems, community grid projects, and waste-to-energy technology.</p> <p>The ADIA is a founding member of OPSWF working group, and as a member was the first one to endorse the ESG principles and frameworks for its operation. ADIA has embedded climate change into its operating system and has been investing in sustainable assets for many years, most visibly in areas such as infrastructure and real estate.</p>

**Annex Table 4.1. Continued**

	<p>ADIA's exposure to labeled bonds, notably green and sustainability bonds, has more than tripled in the past years. ADIA subsidiaries have also been investing in ventures globally to develop renewable energy.</p> <p>ADQ published its sustainability policy in 2021, establishing a framework to embed ESG principles across their operations. ADQ has a sustainability unit that is responsible for developing and implementing its ESG policy and strategy.</p> <p>The United Arab Emirates local green finance projects financed by ADQ include the \$1 billion green ammonia project in Khalifa Industrial Zone Abu Dhabi.</p> <p>ADQ is also involved in cross-border investments to pursue renewable energy opportunities in Oman (wind, solar, and hydrogen projects) and in Kazakhstan (solar energy). ADQ has also allocated \$10 billion in investment for projects that will include renewable energy with Egypt and Jordan.</p>
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Source: Global SWF; IFSWF; OPSWF; and sovereign wealth fund websites.

Note: ADIA = Abu Dhabi Investment Authority; ESG = environmental, social, and governance; KIA = Kuwait Investment Authority; IFSWF = International Forum of Sovereign Wealth Funds; ME&CA = Middle East and Central Asia; NIC NBK = National Investment Corporation of the National Bank of Kazakhstan; OIA = Oman Investment Authority; OPSWF = One Planet Sovereign Wealth Funds; PIF = Public Investment Fund; QIA = Qatar Investment Authority; SWF = sovereign wealth fund; SWFI = Sovereign Wealth Fund Institute; TCFD = Taskforce on Climate-Related Financial Disclosures; TSFE = The Sovereign Fund of Egypt.

## Annex 5. Potential Role of Central Banks in Supporting the Development of Climate Finance and Markets

Central banks can play an important role in addressing challenges of climate change by supporting the development of robust risk management practices and climate finance. As guardians of monetary policy and financial stability, central banks are uniquely positioned in this process, as they have mandates and tools necessary to support countries' progress in the transition to environmentally sustainable and a green economy.

The role of central banks can be key in three areas:

- 1. Mainstreaming climate risks into financial stability assessments:* Central banks are increasingly cognizant of the need to integrate climate risk into their assessments of banking sector soundness (see Box 1). By regularly conducting comprehensive risk evaluation, central banks can identify and understand the specific risk exposure and vulnerabilities of the domestic financial system to climate-related shocks. This enables them to develop robust risk management frameworks, policies, and operational guidance to strengthen the resilience of the domestic financial sectors.
- 2. "Greening" financial institutions:* Central banks can guide financial institutions in adopting sustainable practices by implementing climate-related disclosure requirements and sound frameworks. Through these initiatives, central banks ensure that banks, insurance companies, and other financial entities incorporate climate-related considerations into their lending and investment decisions. This creates better conditions for a prudent allocation of capital to green projects and supports the transition to a low-carbon economy.
- 3. Research and cooperation:* Central banks can contribute to the development of knowledge on climate finance by conducting research and analysis. This includes assessing the economic impact of climate change and assessing the effectiveness of climate policies. Central banks may also work with other stakeholders, such as government agencies, academia, and IFIs, to share expertise and coordinate efforts to develop climate finance and transition to a green future.

Several central banks, particularly advanced economies (for example, the European Central Bank), have also started to incorporate climate considerations in their balance sheet and monetary operations with the rest of the financial sector. The Network for Greening the Financial Sector, which aims to accelerate the development of green finance and provide recommendations on the role of central banks in addressing climate change, has identified nine potential policy options within three areas of credit operations, collateral policies, and asset purchases that can be implemented by central banks. It is important to note that not all options, in a relatively new area, are suitable for every central bank due to legal, operational, and liquidity considerations.

The Network for Greening the Financial Sector has established principles to evaluate the suitability of policies for each central bank. These include ensuring policies do not hinder monetary policy effectiveness or create unintended consequences on financial stability and avoiding distortions in the credit market unless they contribute significantly to climate goals or safeguard the financial system from climate risks. However, determining the adequate climate-related information for central bank action requires a careful balance, considering the risks and costs associated with inaction.

**Annex Table 5.1. Central Banks' Policy Options for Incorporating Climate Risks in Operational Frameworks**

Policy	Description
<b>1- Credit operations</b>	
Adjust pricing to reflect counterparties' climate-related lending	Applying differentiated lending rates based on some counterparty related carbon intensity measure
Adjust pricing to reflect the composition of pledged collateral	Applying differentiated lending rates based on some collateral related carbon intensity measure
Adjust counterparties' eligibility	Limit access to lending windows based on counterparties compliance with climate disclosures or some carbon intensity measure
<b>2- Collateral</b>	
Adjust haircuts	Apply differentiated haircuts based on some collateral related carbon intensity measure
Negative screening	Exclude collateral based on some climate related criteria related to the asset or its issuer
Positive screening	Accept certain collateral based on climate related criteria (such as green bonds or sustainability linked bonds)
Align collateral pools with a climate-related objective	Apply climate-related collateral requirements by counterparties at an aggregate pool level
<b>3- Asset purchases</b>	
Tilt purchases	Prioritize asset purchases based on climate criteria for the asset or issuer
Negative screening	Exclude certain assets or issuers from purchases based on climate related criteria

Source: NGFS 2022.

Implementation of these potential policy options in the ME&CA region has been very limited thus far.<sup>45</sup> Though incorporating climate into central banks' balance sheet and monetary operations could be seen as a way to develop markets, the challenge seems to be that without favorable conditions, notably developed markets and more widespread climate-related standards and requirements, this sequence is likely to be challenging. Operational feasibility, simplicity, data availability, and analytical capacity are important considerations, while markets in the region remain relatively underdeveloped as is the availability of green financial products and standards. Enhancing climate data disclosures and quality would be one crucial first step for the design and then effective implementation of such policies by central banks.

<sup>45</sup> Out of the 32 countries in the ME&CA region, only 12 countries are currently represented in the Network for Greening the Financial Sector through their central bank and/or financial supervisor.

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