



STAFF CLIMATE

NOTES

Planning and Mainstreaming Adaptation to Climate Change in Fiscal Policy

Mathieu Bellon and Emanuele Massetti

IMF STAFF CLIMATE NOTE 2022/003

Planning and Mainstreaming Adaptation to Climate Change in Fiscal Policy

IMF Staff Climate Note 2022/003

Matthieu Bellon and Emanuele Massetti*

DISCLAIMER: The IMF Notes Series aims to quickly disseminate succinct IMF analysis on critical economic issues to member countries and the broader policy community. The IMF Staff Climate Notes provide analysis related to the impact of climate change on macroeconomic and financial stability, including on mitigation, adaptation, and transition. The views expressed in IMF Staff Climate Notes are those of the author(s), although they do not necessarily represent the views of the IMF, or its Executive Board, or its management.

RECOMMENDED CITATION: Bellon, Matthieu, and Emanuele Massetti, 2022. “Planning and Mainstreaming Adaptation to Climate Change in Fiscal Policy.” IMF Staff Climate Note 2022/003, International Monetary Fund, Washington, DC.

ISBN:	979-8-40020-195-0 (Paper) 979-8-40020-204-9 (ePub) 979-8-40020-198-1 (PDF)
JEL Classification Numbers:	H20; H50; H60; O23; Q54; Q58
Keywords:	Climate change, adaptation, fiscal policy, public financial management.
Authors’ email addresses:	mbellon@imf.org emassetti@imf.org

* The authors are grateful to James Daniel and James Roaf for continuous support and extensive comments. They thank Ozlem Aydin and Guohua Huang (FAD) as well as Isabela Duarte, Emilio Fernandez-Corugedo, Alejandro Guerson, Janne Hukka, Marie Kim, and Sónia Munoz (all WHD) for important contributions, Andrew Ceber (FAD) for providing very valuable inputs and feedback, IMF and WB colleagues for helpful comments and suggestions, Joey Kilpatrick and Von Allena for first-rate research assistance.

Planning and Mainstreaming Adaptation to Climate Change in Fiscal Policy

Matthieu Bellon and Emanuele Massetti

March 2022

Summary

Adaptation to climate change is an integral part of sustainable development and a necessity for advanced and developing economies alike. How can adaptation be planned for and mainstreamed into fiscal policy? Setting up inclusive coordination mechanisms and strengthening legal foundations to incorporate climate change can be a prerequisite. This Note identifies four building blocks:

1. Taking stock of present and future climate risks, identifying knowledge and capacity gaps, and establishing guidance for next steps.
2. Developing adaptation solutions. This block can be guided by extending the IMF three-pillar disaster resilience strategy to address changes in both extreme and average weather and would cover the prevention of risks, the alleviation of residual risks, and macro-fiscal resilience.
3. Mainstreaming these solutions into government operations. This requires strengthening public financial management institutions by factoring climate risks and adaptation plans into budgets and macro-frameworks, and in the management of public investment, assets and liabilities.
4. Providing for transparent evaluations to inform future plans. This involves continually monitoring progress and regularly updating adaptation plans.

This Staff Climate Note is part of a series of three Notes (IMF Staff Climate Note 2022/001, 2022/002, and 2022/003) that discuss fiscal policies for climate change adaptation. A first Note (Bellon and Massetti 2022, henceforth Note 1) examines the economic principles that can guide the integration of climate change adaptation into fiscal policy. It argues that climate change adaptation should be part of a holistic, sustainable, and equitable development strategy. To maximize the impact of scarce resources, governments need to prioritize among all development programs, including but not limited to adaptation. To this end, they can use cost-benefit analysis while ensuring that the decision-making process reflects society's preferences about equity and uncertainty. A second Note (Aligishiev, Bellon, and Massetti, 2022, henceforth Note 2) discusses the macro-fiscal implications of climate change adaptation. It reviews evidence on the effectiveness of adaptation at reducing climate change damages, on residual risks, and on adaptation investment needs, and suggests ways to integrate climate risks and adaptation costs into national macro-fiscal frameworks with the goal of guiding fiscal policy. It stresses that lower-income vulnerable countries, which have typically not contributed much to climate change, face exacerbated challenges that warrant increased international support. This third Note considers how to translate adaptation principles and estimates of climate impacts into effective policies.

Laying the Groundwork: Legal Foundations and Adaptation Planning

Adaptation to climate change is a necessity for advanced and developing economies alike. Climate is changing and will continue to change even with intensive mitigation efforts (Note 1). It would be beneficial for countries to start planning for new climate conditions now, developing adaptation policies and strengthening their implementation capacity (Note 1). Despite all the potential benefits, adaptation cannot replace mitigation. Adaptation and mitigation are both needed to help reduce damages from climate change. Without strong mitigation, it is not possible to stabilize global temperature, and adaptation would become either impossible or too expensive.

Some countries could consider strengthening institutions to effectively support climate adaptation when needed. Adaptation is a cross-cutting issue requiring a whole-of-government approach. It is recommended to incorporate adaptation in all phases of policy development from legislation to implementation as well as in all sectors and levels of government. Governments can start by creating or designating a coordination structure, allocating responsibilities, and establishing a process to involve relevant stakeholders.

National legal frameworks might need to be strengthened to provide the legal foundation for establishing adaptation processes and institutions, and for mandating adaptation planning. Some countries (for example, Kazakhstan, Vietnam) incorporated climate change into existing national laws (for example, environmental codes, sectoral laws). Other countries (for example, Japan, United Kingdom) opted for stand-alone framework laws such as climate laws or climate adaptation laws. Framework legislation can be useful for building a wide-ranging and coherent approach to climate adaptation. While statutory provisions vary widely, common areas of focus include information generation and sharing, adaptation planning, establishing institutional arrangements, and processes for managing and monitoring adaptation actions. Countries would benefit from evaluating strengths and weaknesses of existing legal frameworks to identify remaining gaps (Nachmany, Byrnes, and Surminski 2019).

Adaptation policies would benefit from being guided by plans that are articulated with other development plans. Adaptation plans aim at reducing vulnerability to climate change by increasing adaptive capacity and resilience, and at facilitating the integration of adaptation into new and existing policies, programs, and activities, within all relevant sectors. Countries around the world are increasingly developing, adopting, and updating national adaptation plans (NAPs) to guide their adaptation policies as required by Article 7 of the Paris Agreement (2015) (see Figure 1).

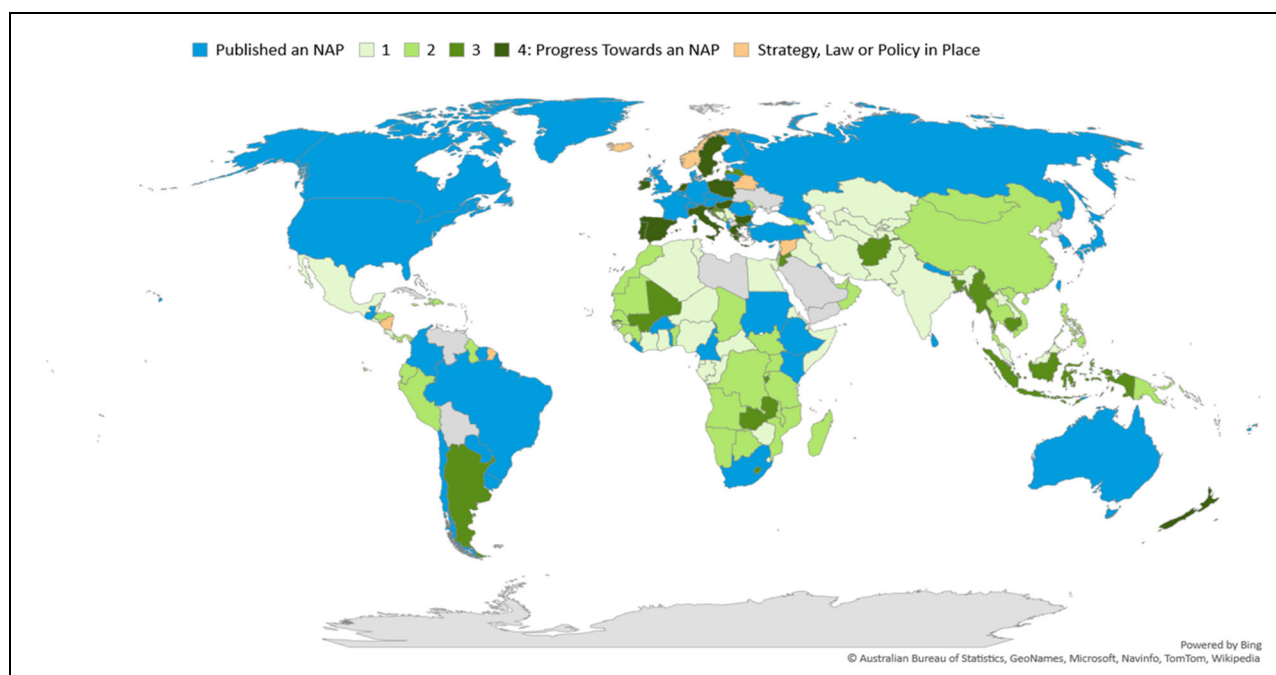
Adaptation plans can be organized around four essential blocks (Figure 2). A prerequisite to the development of adaptation plans is the identification of institutional arrangements and coordination mechanisms as well as the consultation of key stakeholders. This is important to maximize ownership and facilitate the circulation of information. Then, the international community (for example, UN Framework Convention on Climate Change [UNFCCC] 2012; European Commission 2018; World Bank 2021) has established four building blocks that are essential to an NAP process:

- **Identifying climate vulnerabilities and adaptation gaps.** This includes (1) stock-taking and synthesizing information on climate change impacts and climate vulnerabilities; (2) identifying information gaps, capacity gaps, and weaknesses in terms of planning for adaptation; (3) developing a roadmap for the NAP process and its implementation; and (4) establishing guidance on normative principles for adaptation (Note 1 provides a discussion of such principles).

- **Identifying adaptation solutions.** Finding solutions starts with addressing information gaps by supporting, disseminating, and training on relevant climate adaptation data and concepts with all stakeholders. Further, this involves identifying potential solutions to identified climate vulnerabilities and adaptation needs that coincide with national development plans, estimating the costs and benefits of adaptation options as well as their distributional impacts, and communicating these solutions to the public.
- **Mainstreaming of adaptation in public financial management (PFM).** This includes (1) mainstreaming climate adaptation into national planning (national development plans, sectoral plans and strategies, disaster risk management plans, spatial planning, building regulations), (2) incorporating climate risk management and estimated adaptation needs in budget and financing plans, and (3) enhancing implementation capacity.
- **Monitoring, evaluation, and reporting.** This involves continually monitoring progress made, reevaluating adaptation plans, and regularly updating those plans.

As more information about climate change and technical solutions become available, NAPs will have to be updated and improved.

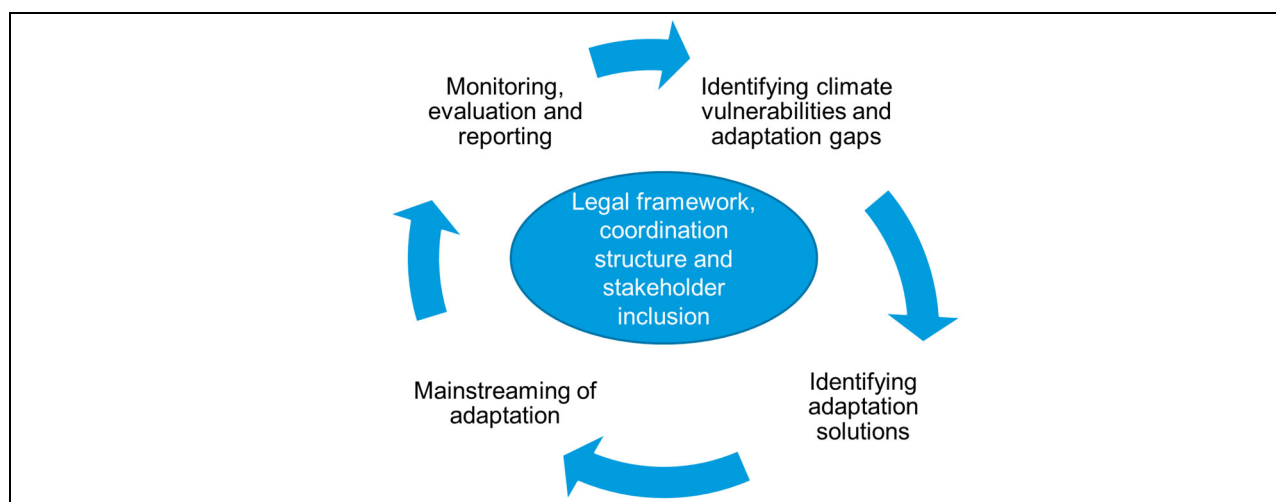
Figure 1. Global Progress Toward National Adaptation Plans



Sources: European Commission (2018); UN Framework Convention on Climate Change (2012); United Nations Environment Programme (2021); and IMF staff assessment.

Note: Progress toward the publication of a full-fledged national adaptation plan is assessed according to UN Framework Convention on Climate Change guidelines. The guidelines are articulated around four main blocks, which are themselves divided further in a total of 23 measures. A country is considered to have taken a step if any of the detailed measures underpinning a block has been completed (Annex 1). Light orange indicates countries for which the information collected was not sufficient to reach a conclusion on progress towards the publication of a full-fledged NAP, but have an adaptation law, strategy or policy in place according to United Nations Environment Program (2021). Gray denotes countries for which the information collected was not sufficient to reach a conclusion.

Figure 2. Adaptation Plan Structure



Source: IMF staff.

Adaptation Solutions

The (IMF 2019a, 2021c; Grenada 2021) three-pillar approach to natural disasters can be extended to guide the identification of adaptation options, the second block of NAPs. The three-pillar Disaster Resilience Strategy developed in an IMF Board Paper (IMF 2019a) can be extended to cover all dimensions of climate change, including continuous changes such as sea-level and temperature rise, and to cover countries of all sizes and income levels (Box 1). The extended framework retains a three-pillar structure and nests the Disaster Resilience Strategy. The *prevention* pillar addresses policies to reduce all climate risks and their impacts. The *alleviation* pillar focuses on policies to address the realization of residual climate risks. The *macro-fiscal resilience* pillar provides guidance to secure resilient financing sources that can meet funding and financial liquidity needs.

The Prevention Pillar

Fiscal policy can provide a wide array of public goods and incentives to facilitate the adaptation of firms and people and reduce climate risks and their impacts. Public investment has a key role to play in the provision of public infrastructure and can potentially play an important role in research and development as well as in markets characterized by networks (Note 1). Climate-resilient and protective public infrastructure needs to be complemented with adequate maintenance. Direct and targeted transfers in the form of taxes, fees, subsidies, or tax expenditures can correct market failures and incentivize private resilience when risks are not priced adequately. Beyond fiscal policies, zoning and regulations can be other tools to avoid moral hazard and reduce overall risk exposure. In particular, the following areas of intervention deserve close examination:

- **The provision of public information.** Accurate information about risks can influence public and private sector decisions on how and where to locate and develop economic activities. For example, risk maps on flood zones, areas at risk from coastal erosion, and landslide areas can provide valuable information to property investors. Such information could facilitate the construction of private commercial and residential properties in safer areas or with higher resilience standards. Where there is a developed insurance industry, this can help in setting terms and conditions for property cover. Public early warning systems with adequate resources

are also crucial to prevent the loss of lives (for example, hydrometeorological and communication systems).

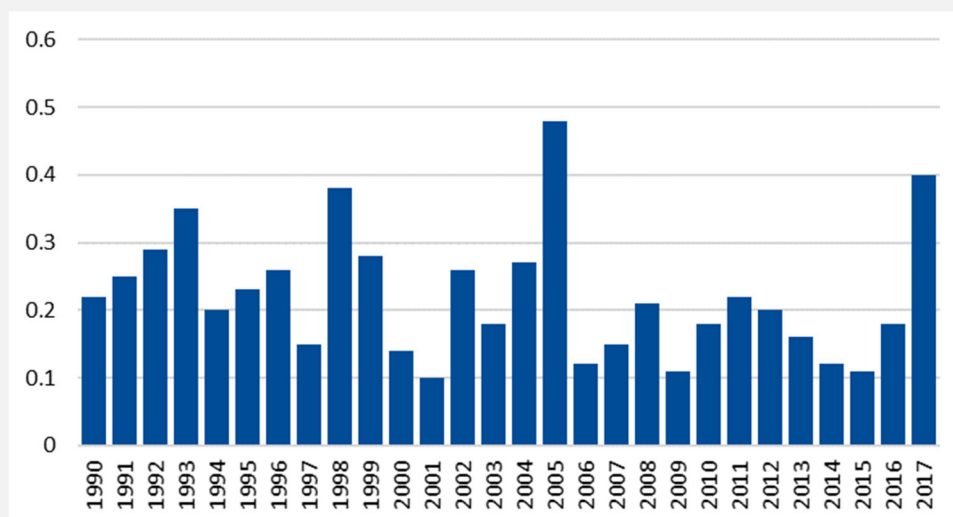
- **The reduction of inefficient risk-taking.** Accurate pricing of risks is key to incentivize agents into allocating resources efficiently from a social point of view. Governments may consider addressing the policy or market failures that distort efficient risk pricing (Note 1). Information on risks could be made more salient and be used to reduce inefficiency, for example by lowering public contributions for high-risk areas and for construction with inadequate resilience or protective standards. Subsidies to risk reduction like accelerated capital depreciation provisions and tax schemes (for example, tax credits) can incentivize the upgrade and replacement of private physical assets to enhance their resilience (for example, against floods or storms) and make them more protective (for example, providing protection against outside heat). However, subsidies to risk reduction can inefficiently lower the cost for private agents of investing in risky areas. Feebates—hybrid systems where agents that take risks above the market average are taxed while agents that take risks below the market average are subsidized—can be more politically feasible and sometimes more efficient. One advantage of feebates is that they can be calibrated to be self-funding. In general, incentives could be designed to be targeted to relevant sectors and technologies and should avoid downside risks such as redundancy and “lock-in” effects. Depending on the circumstances, regulations, such as construction standards and zoning, can complement financial incentives (for example, by limiting new constructions in flood plains or coastal areas exposed to sea-level rise, or by expanding forest coverage that protects against heat and mangroves that protect against floods), at little or no direct fiscal cost.

Box 1. Extending the IMF Disaster Resilience Strategy for Climate Change Adaptation

In 2019, the Executive Board of the IMF approved the Disaster Resilience Strategy (DRS), a framework for building resilience to large natural disasters in vulnerable developing countries (IMF 2019a). The framework was developed to address the macroeconomic risks of natural disasters for small or poor countries, and the associated challenges related to financing, policy implementation, and the coordination of development partners’ support. It follows a large body of work (the Sendai Framework for Disaster Risk Reduction and World Bank work now integrated and recapped in Hallegatte, Rentschler, and Rozenberg 2020) and is based on a three-pillar strategy involving (1) ex ante investment to limit the impact of natural disasters, (2) financial resilience including fiscal buffers and prearranged financial instruments to protect fiscal sustainability and manage recovery costs, and (3) contingency planning to address ex post disaster needs. Subsequently, Grenada and Dominica adopted the framework to develop their national DRS (IMF 2021c; Grenada 2021).

The climate change adaptation framework presented in this note extends the DRS approach to cover a broader set of issues. Climate change will alter the entire distribution of weather conditions, including both average and extreme conditions, and is likely to trigger changes that are not limited to weather events, like changes in sea level, water reserves, biodiversity, migration patterns, etc. In fact, many of the adverse effects of climate change at the global level and for large countries may not be caused by disasters, as these only cause large damages infrequently and over limited areas, but by gradual changes that will have a permanent effect. Such changes include permanently hot temperatures and sea-level rise. At the global level, disaster losses as a share of GDP have remained broadly stable over the last two decades at about 0.2 percent of GDP (Figure 1.1). Even if climate change increases these disaster costs manifold, they would continue to represent a relatively small fraction of the range of costs estimated in the literature (Note 2).

Figure 1. Weather Disaster Losses as a Share of GDP, 1990–2017



Source: Our World in Data quoting from Pielke (2018).

The focus provided in the DRS framework remains appropriate for small and poor countries for which natural disasters are a macro-critical source of risks. While the scope of the climate adaptation framework is broader, the DRS framework has the level of detail that is relevant for small countries prone to natural disasters, including those unrelated to climate like earthquakes and tsunamis. The clear mapping between frameworks should facilitate their joint use.

Addressing all the effects of climate change for all countries requires a change in the coverage of pillars and needs that can be better reflected with a change in terminology.

- The DRS first pillar (“ex ante interventions to limit the impact of natural disasters, through investments in resilient infrastructure, early warning systems, and improved building codes and zoning rules”) becomes the *prevention* pillar to cover the necessity of addressing all risks stemming from climate change. This includes addressing gradual acceleration in capital depreciation, gradual productivity losses (and potentially productivity gains in some regions and sectors), and issues related to the lack of information and certainty about future risks. Solutions to cover those risks include, for example, investing or researching new crops better suited to different average conditions, investing in different tourism activities for mountain resorts with declining snowfall, building better insulated or smarter homes, addressing the underutilization of hydropower plants that have less water to work with, etc.
- The DRS second pillar (“financial resilience including fiscal buffers and prearranged financial instruments to protect fiscal sustainability and manage recovery costs”) becomes the *macro-fiscal resilience* pillar and is broadened to encompass the added challenge of financing the solutions to all types of climate risks.
- The DRS third pillar (“contingency planning to address ex post disaster needs”) becomes the *alleviation* pillar to address all residual climate risks, as these will not be limited to post-disaster risks. Governments may also want to support sectors and populations affected by slow and gradual changes, like the farmers whose crops have declining yields with the change in average weather conditions or ski resort workers.

- **The provision of infrastructure and new technologies.** Governments can make public infrastructure more resilient and ensure that needed public service delivery can withstand adverse climate conditions. They can play a crucial role in providing protective infrastructure (for example, coastal protection against sea-level rise or water management systems to handle adverse precipitation patterns) in cases supported by cost-benefit analyses in a broad sense (Note 1). When new climate conditions require a coordinated reorientation of market activities or the setup of networks, governments could consider strategic investments to overcome coordination issues or scaling issues in case of increasing returns to scale. This could be the case when transitioning away from a vertically integrated agricultural chain based on a crop with declining yields because of new climate conditions, or when relocating industrial clusters away from exposed areas. Additionally, direct investment or indirect support to research and development could be considered when markets fail to invest in large, risky, or long-term projects (for example, the development of more adapted crop varieties or vaccines and treatments against new diseases emerging from new climate conditions).

Financial inclusion can be crucial for the private sector to develop adapted risk-prevention strategies. Private capital markets are expected to provide financing for viable investments in risk reduction, such as protective infrastructure, the strengthening of existing assets, and the transition to less risky locations and activities. Structural reforms are the best tool to improve financial access when needed (IMF 2020, 2018a) but fiscal policy could provide additional support (for example, with guarantees or subsidies).

For equity and efficiency reasons, governments are recommended to pay particular attention to the most vulnerable when developing and designing prevention policies. Adaptation programs can be prioritized based on cost-benefit analysis while also ensuring that the decision-making process reflects society's preferences about inequality (Note 1). As some vulnerable groups may be disproportionately affected by climate change, society's inequality-reduction goals may warrant additional support that can take the form of prevention policies (for example, developing and distributing drought-resistant varieties of seeds to poor farmers). Further, poor households and small and medium enterprises face greater challenges in preventing climate risks because of financial exclusion or their lack of access to information. For these reasons, supporting their adaptation directly or enhanced efforts to address the market failures that prevent them from adapting has the potential to yield larger returns. In the case of direct adaptation support, different forms of support should be evaluated, including against alternatives (for example, additional cash transfers through new or existing programs) that have the potential to yield greater welfare benefits that are not specific to adaptation (Note 1).

The Alleviation Pillar

Governments would benefit from planning how to alleviate the realization of adverse residual climate risks. It is rarely cost-efficient or even possible to eliminate all risks. Therefore, residual risks need to be addressed. The cost of climate change is equal to the cost of adaptation and the costs from residual climate risks (Note 2). Improving the efficiency of policies that alleviate residual risks would further contribute to reduce total climate change costs. This goal can be reached with carefully designed contingency plans and social safety nets.

Disaster contingency plans are essential to ensure timely post-disaster support and reconstruction. Public responses to disasters can fall short because of delays in agreeing on intervention priorities, time taken to resolve leadership and coordination issues across multiple levels of

government and with foreign counterparts, and lack of short-term financing (Clarke and Dercon 2016). Contingency plans for post-disaster action with transparent intervention rules, clear leadership responsibilities, and alignment with key vulnerabilities are essential to address these shortcomings. Disaster risk reduction is a systematic approach to identifying, assessing, and reducing the risks of disaster, especially at the local level (an indicator of progress under the Sustainable Development Goal 13 climate action). For example, Indonesia's integrated disaster risk reduction approach is often cited among best performers (Global Facility for Disaster Reduction and Recovery 2018). Governments can also play a role in strengthening private sector resilience, as illustrated by Japan which imposes requirements and targets for business continuity plan adoption by private companies.

Financial inclusion is a prerequisite for the private sector to cope with residual climate risks.

Access to safe liquid savings accounts, emergency borrowing, and insurance is crucial for households and firms to withstand climate shocks. Thus, fiscal policy can also contribute to resilience by supporting and promoting financial access with nondistortive taxation and adequate incentives (for example, helping social program beneficiaries with accessing bank accounts). Ideally, the financial system would provide insurance and hedging instruments.

Social safety nets can help to alleviate the adverse impacts from both extreme events and slow-moving transformations due to climate change. They can support vulnerable firms and households during the transition period before they adapt to new climate conditions, and support those impacted by permanent productivity losses. When fixing financial market failures is not feasible in the short term, social programs can help vulnerable firms and households with limited access to commercial or self-insurance to withstand and recover from extreme events. Accurate risk assessment supports adequate risk management and helps to safeguard the sustainability of social programs. This argues for financing plans supporting social programs to transparently factor in increased post-disaster needs (implicit liabilities), reflect on the costs of risk taking (for example, risky location decisions), and account for the long-term needs due to the permanent effects of climate change.

When adaptation solutions are not affordable, compensation could be considered. There might be areas where investing in protective infrastructure has a negative net present value (NPV). For example, it might be too expensive to protect a coastline from sea-level rise when there are only very few inhabitants. Under the same equity considerations, there can nevertheless be a case for compensating the affected inhabitants and supporting their relocation (Note 1).

All these support programs need to factor in and balance equity and efficiency considerations.

Social protection systems can be made “adaptative” to improve targeting in a timely manner by either expanding the list of beneficiaries or increasing transfers to existing beneficiaries, as in Fiji and Jamaica (IMF 2016). Program design can help overcome equity-efficiency trade-offs by strengthening the efficacy of social policies and avoiding unintended effects, such as discouraging people from switching to less climate-sensitive sectors or relocating to safer areas when programs target specific sectors or areas. Making benefits portable across different states or regions help people migrate away from areas negatively hit by natural hazards. Additional or conditional benefits can incentivize adaptation actions (for example, relocation to safer locations, opening savings account), if they are efficiently deployed and targeted to avoid crowding-out private efforts. Cash transfers or vouchers instead of food and clothing aid

can mitigate corruption risks and the disruption of value chains that would undermine the livelihoods of local merchants (where local markets can meet needs).¹

The Macro-Fiscal Resilience Pillar

This pillar focuses on tailoring financial strategies to ensure macro-fiscal resilience to residual risks and sustainable and timely financing of adaptation policies. A comprehensive strategy would mainly consist of two objectives: (1) ensuring adequate fiscal space and the mobilization of financial resources for adaptation policies under the prevention and alleviation pillars despite added costs from residual risks, and (2) insurance against large risks and securing timely access to liquidity in the aftermath of climate disasters.

Reflecting climate costs in macro-frameworks and public sector balance sheets is a prerequisite to the development of sound financial strategies. Even before contemplating investing in adaptation, the macro-fiscal baseline should incorporate the unmitigated effects of climate change as this is necessary for the evaluation and prioritization of adaptation programs. Incorporating the fiscal implication of climate costs is also necessary to quantify the risks to fiscal sustainability and develop corrective policies. Note 2 reviews the literature on the macro-fiscal implications of climate change adaptation and suggests ways to integrate climate risks and adaptation costs into national macro-fiscal frameworks.

Climate change will challenge fiscal sustainability in two ways. First, with respect to a baseline scenario without climate impacts, the unmitigated effects of climate change (residual risks) will generate direct passive losses for the public sector through lower revenue (for example, GDP losses that translate into a reduction of the tax base), increased expenditure (for example, increased interest rate risk premium as in Cevik and Jalles 2020, 2021; or a greater use of automatic stabilizers), the accelerated depreciation or outright destruction of public assets, and the realization of implicit liabilities (for example, when governments bail out failing private agents). Second, active adaptation policies under the prevention and alleviation pillars may generate public revenue that do not cover the totality of costs or that might only do so after a long period.

Fiscal space and diversified revenue sources contribute greatly to resilience to climate change shocks. Fiscal space (sustainable fiscal balances and debt levels) facilitates access to financing at lower cost for all public development policies, including adaptation policies. Additionally, it contributes to avoiding crowding out the financing available for private sector adaptation. Tax systems that rely on a few vulnerable sectors, as could be the case in a small agricultural country prone to droughts, is a source of financial vulnerability that warrants addressing, either by diversifying the tax base or by engaging in financial insurance schemes.

Note 1 argues that, in most cases, adaptation programs should only be implemented if they have a positive Net Present Value (NPV) for society. The NPV is equal to the changes in consumer, producer, and government surplus, discounted and summed over the entire lifetime of the program. The change in government surplus is equal to the revenues generated by the program minus the expenses. A positive NPV does not guarantee that the change in the government surplus is positive, or equivalently that the adaptation program is self-financing.

¹ In some countries, labor-intensive public works programs providing post-disaster income support can be more politically amenable and can contribute to reconstruction and recovery.

Many adaptation programs won't be self-financing and, together with the fiscal costs of residual risks, will require creating fiscal space, greater financing, or both. For such adaptation programs, countries will face a choice of raising revenue, cutting other spending, or increasing financing. In the case of small lower-income and vulnerable countries, with highly constrained domestic revenue raising and financing capacity, and high spending needs to achieve their Sustainable Development Goals, this calls for increased concessional international support (Note 2).

Some adaptation policies can be self-financing over the long term but may require temporary financing because benefits only accrue after upfront costs. Self-financing investments typically require robust PFM systems to ensure that adaptation projects are carefully evaluated, adequately prioritized among other development projects, and efficiently implemented. With efficient PFM systems, investing in resilience can pay off by generating additional revenue (for example, investment in solar-powered energy plants), safeguarding the tax base (for example, coastal protection), and lowering spending needs (for example, resilient infrastructure requiring lower maintenance and repair costs, disaster risk reduction programs resulting in lower post-disaster needs). In such cases when benefits are only realized long after costs are paid, it is necessary to secure financing on affordable terms. Some studies make the case that there are indeed substantial self-financing investment opportunities in small vulnerable countries and stress that the donor community would benefit from financing such projects by saving on post-disaster aid relief (Cebotari, Youssef, and Ramakrishnan 2020; Melina and Santoro 2021; IMF 2019a; Cantelmo, Melina, and Papageorgiou 2019).

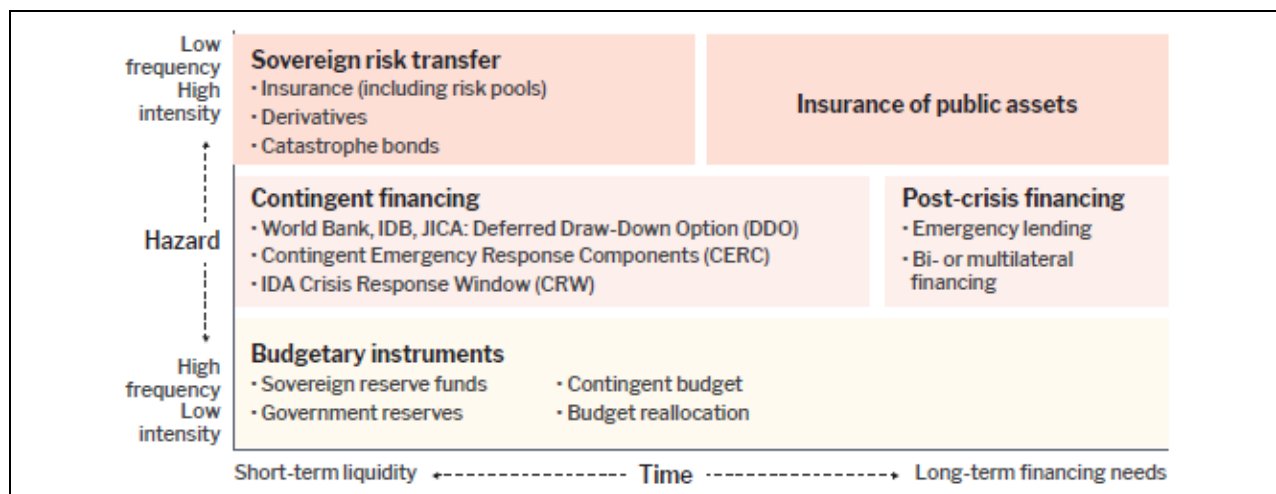
Weather disasters can generate pressing financing and liquidity needs that require adapted insurance strategies (IMF 2016, 2019a; Hallegatte, Rentschler, and Rozenberg 2020; Cevik and Huang 2018). Climate disasters destroy capital and temporarily lower productivity, thereby generating potentially large reconstruction and humanitarian needs (Note 2). There are typically large opportunity costs of delaying reconstruction and humanitarian aid. Therefore, it can be crucial to have insurance solutions for countries with otherwise constrained or limited access to international finance (Box 2). Different instruments are best suited to address shocks of different frequencies (see Agarwal and others 2021 for a survey of actions taken in South Asia).

- *To address small recurring shocks*, self-insurance in the form of budgetary instruments is an inexpensive and flexible solution (for example, budget reallocations within the confines of the approved budget or supplementary budgets, provisions, or reserve funds). For example, Mexico created FONDEN as a budgetary tool to rapidly allocate federal funds for rehabilitating public infrastructure affected by disasters. Evidence shows that FONDEN has significant benefits, increasing local GDP post-disaster by 2 to 4 percent, with a benefit-cost ratio estimated conservatively between 1.5 and 2.9 (de Janvry, del Valle, and Sadoulet 2016). Gislen and Guerson (2018) propose a savings fund for The Bahamas of 2 to 4 percent of GDP and simulates the size and annual budget contributions for a savings fund in Jamaica.
- *For larger disasters*, instruments that transfer risks to international markets, although expensive, might be beneficial (IMF 2018b). Insurance and state-contingent debt instruments reduce default risks for investors and imply net financing for debtors when facing large shocks (see Guerson 2021 for a literature review of state-contingent debt instruments). These instruments include contingent credit lines from development partners (IMF 2021d), regional risk-sharing facilities (for example, the Caribbean Catastrophic Risk Insurance Facility, the Pacific Catastrophe Risk Assessment and Financing Initiative, the African Risk Capacity, and the South Asia Disaster Risk Insurance Facility), private insurance (IMF 2021b, 2021f), and catastrophe bonds (Figure 3). Mexico's FONDEN has also a contingency fund that leverages private sector financing as part of

a strategy that combines risk retention and risk transfers: catastrophe bonds are issued to transfer some of Mexico's earthquake risk to the international capital markets.

Governments can support adaptation by promoting efficient financial risk management in the private sector. Ensuring adequate private risk management would be beneficial for government budgets by reducing government assistance needs. Financial regulations could be strengthened to that end. The same layering approach could prevail for private agents: savings and provisions can be encouraged for frequent risks, whereas insurance products can be promoted against large but infrequent shocks.

Figure 3. Financing Instruments to Cover Contingent Liabilities from Natural Disasters



Source: Hallegatte, Rentschler, and Rozenberg 2020.

Note: IDA = International Development Association; IDB = Inter-American Development Bank; JICA = Japan International Development Cooperation Agency.

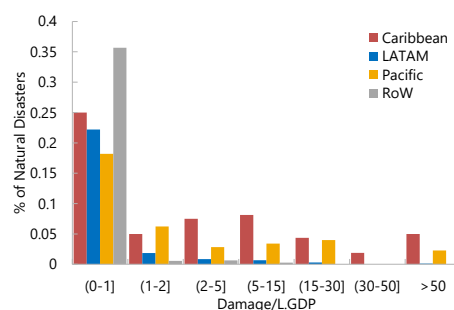
The optimal strategy to build resilience is a mix between structural protection and financial protection (Guerson 2020; Melina and Santoro 2021). Insurance does not avoid disaster damages but alleviates financial constraints and thereby allows for timely reconstruction and consumption smoothing (assuming pooling across differentially exposed locations is available). Adaptation investment that reduces risk is still desirable as it contributes to lower insurance premiums (as well as lowering other damages). At the optimum, the marginal benefit of adaptation (that is, the expected reduction in damages) would be equal to the marginal reduction of the insurance premium plus any residual costs after insurance.

The optimal mix of structural and financial protection depends on fiscal space, financial market access, the extent of climate change damages, structural adaptation costs, and public investment efficiency. IMF (2019b) and Cantelmo, Melina, and Papageorgiou (2019) suggest that risk-reduction infrastructure is the best strategy for a government that is not subject to financial constraints as it would be able to reconstruct the public capital destroyed by residual risks as needed. For countries with limited fiscal space and borrowing constraints, the availability of liquidity to finance reconstruction is crucial and financial protection becomes important. Low efficiency of public investment would further tilt the balance in favor of financial protection.

Box 2. Building Financial Resilience to Natural Disasters in the Caribbean¹

The Caribbean is one of the world's most vulnerable regions to climate-related natural disasters (CRND), incurring large and recurrent social and economic costs (Figure 2.1). Between 1980 and 2020, Caribbean countries have incurred seven CRNDs per year on average with annual damages averaging 2½ percent of GDP. The region is also subject to large climate events with 17 percent of all CRND exceeding damages of 20 percent of GDP. Academic estimates point to an immediate negative GDP impact of CRNDs ranging between 0.1 to 3 percent in the Caribbean—with permanent effects from large CRNDs—and a contemporaneous increase in public expenditure by around 4 percentage points of GDP.² IMF staff estimates in Request for Disbursement Under the Rapid Credit Facility staff reports are consistent with these results with a mean growth revision after CRNDs of around 1.4 percent and an increase in public spending of 2.3 percentage points of GDP.³

Figure 2.1. Distribution of Damages per Climate-Related Disasters

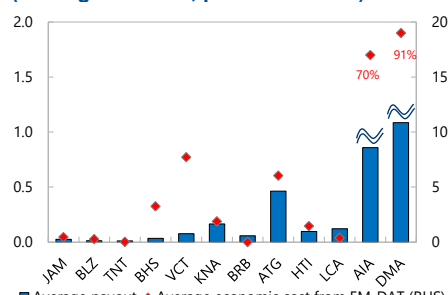


Sources: EM-DAT database; and IMF staff calculations.
Note: LATAM = Latin America; RoW = rest of world.

Caribbean countries have invested in structural and financial resilience, but important gaps remain. IMF-World Bank Climate Change Policy Assessments estimate investment gaps in structural resilience building (the difference between investments that have a clear economic benefit and current investment levels) at 2–3 percent of GDP a year over a decade or more in the Caribbean (IMF 2019a). Moreover, cost considerations and limited fiscal space limit countries' ability to purchase substantial disaster insurance for financial resilience. Although many Caribbean countries have government saving or wealth funds, only Dominica and St. Vincent and the Grenadines have funds dedicated specifically to self-insurance against natural disasters.⁴

The amounts saved, however, remain short of needs, in part due to the frequency of natural disasters and other external shocks such as the COVID-19 pandemic. Most Caribbean countries are currently accessing natural disaster insurance under the Caribbean Catastrophe Risk Insurance Facility, which provides parametric insurance triggered by weather developments (as opposed to damages). This raises concerns that large damages may occur without triggering the payment clause (Figure 2.2). The use of innovative state-contingent instruments to provide debt service relief in the event of a natural disaster has been limited, given their complexity, high setup costs, and capacity/regulatory constraints. Jamaica is the only country that has issued a catastrophe bond in the Caribbean, and Grenada and St. Vincent and the Grenadines the only countries enrolled in the World Bank's CAT Deferred Drawdown Option. Hurricane-linked clauses in debt contracts were used by Barbados and Grenada during debt restructuring. Bond issuance in financial markets has not taken place due to high cost, market's low

Figure 2.2. CCRIF Payout to the Caribbean Countries (Average 2007–21, percent of GDP)



Sources: Caribbean Catastrophe Risk Insurance Facility (CCRIF); EM-DAT; and IMF World Economic Outlook database.

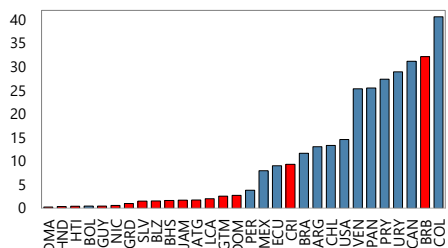
Note: Data labels use International Organization for Standardization (ISO) country codes.

acceptance, and high data transparency requirements related to indexation to economic developments.

Private sector insurance coverage is limited by high costs. Nonlife insurance penetration in the Caribbean lags when scaled against estimates of average climate-related damages. Property insurance is typically a requirement for housing loans, but anecdotal evidence points to insurance lapse upon repayment due to high costs. This reflects the market's small size and high susceptibility to natural disasters, where primary insurers are heavily reliant on overseas reinsurance and largely pass disaster-sensitive reinsurance pricing through to customers. For instance, following a high-damage hurricane season, the regional reinsurance costs in 2018 increased by 10–40 percent, with the largest increases in directly impacted countries.

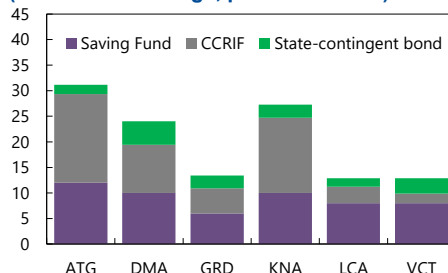
Scaling up investment in structural and financial resilience requires concessional financing and would yield significant long-term benefits to the Caribbean. Investing in structural resilience can boost the level of GDP in the long term for Caribbean islands, even if no disaster occurs. But because building structural resilience takes time, financial resilience would also be needed to ensure funding for reconstruction while safeguarding public finances. Boosting insurance coverage to 15–30 percent of GDP for Caribbean countries could cover 99 percent of the fiscal costs related to natural disasters (IMF 2021a). The upfront fiscal costs of structural and financial resilience would open a transitional financing gap for governments because the benefits of climate resilience accrue over the medium and long term. For small Caribbean states like Dominica, the total cost of building resilience is potentially very large and would require over a decade to fully execute (IMF 2021c). Therefore, the availability of external concessional financing, including international climate funds, and the preparation of a comprehensive disaster resilience strategy would be key.

Figure 2.3. Insurance Penetration relative to Average Climate Related Damages (Percent of GDP)



Sources: Insurance penetration represents the latest available annual data of nonlife insurance (as percent of GDP) for each country in the October 2019 World Bank Global Financial Development database. Average climate related damages (as percent of GDP for 1980–2020) are from EM-DAT and IMF staff calculations.
Note: Data labels use International Organization for Standardization (ISO) country codes.

Figure 2.4. Natural Disaster Insurance Coverage and Layering (Insurance coverage, percent of GDP)



Sources: National authorities; and IMF staff calculations.
Note: Authorities' data and disaster loss function estimates from Caribbean Catastrophe Risk Insurance Facility (CCRIF). Calibrated to achieve coverage of 99 percent of disaster loss. Includes risk of tropical cyclones and earthquakes. Data labels use International Organization for Standardization (ISO) country codes.

¹ This box was prepared by Isabela Duarte, Emilio Fernandez-Corugedo, Alejandro Guerson, Janne Hukka, Marie Kim, and Sónia Munoz.

² Most studies also include geological disasters. Acevedo (2014) reports GDP effects between 0.1 percent for a moderate storm to 3 percent for severe floods. Rasmussen (2004), Hsiang (2010), Strobl (2012), Bello (2017), and Lian, Moran, and Vishvesh (forthcoming) find estimates within Acevedo's range, with the average impact of around 1½ percent of GDP. Heger, Julca, and Paddison (2008) find an impact of 23 percent. The estimates on the impact on revenue and public debt are inconclusive as donor contributions have offsetting effects.

³ See IMF staff reports for Dominica (2012, 2015), Haiti (2015), St. Lucia (2010), and St. Vincent and the Grenadines (2011, 2014).

⁴ Antigua and Barbuda and Belize are in the process of creating a savings fund.

Building Capacity for Adaptation

Capacity development would help vulnerable and low-capacity countries to better identify adaptation solutions and related macro-fiscal impacts. The IMF can contribute to global efforts towards capacity building on adaptation (see IMF 2021e for an overview of the IMF’s strategy to help members address climate change related policy challenges). The IMF’s adaptation-related capacity development covers Climate Macroeconomic Assessment Programs (CMAP— a comprehensive and granular assessment of country-specific climate vulnerabilities, adaptation policies, and financing needs to build resilience), and focused climate-related support (on topics such as green PFM).

Mainstreaming Adaptation in Public Financial Management²

Mainstreaming Adaptation in Public Financial Management

Well-integrated planning and budgeting functions are key for implementing adaptation plans.

Planning establishes a framework of government goals, policies, and targets, including on adaptation, while budgeting puts these policies into a defined fiscal envelope. The medium-term fiscal framework should link long-term adaptation objectives in national plans and short- to medium-term budget resources (immediate expenditure, revenue, and financing plans). It provides strategic guidance to ensure that annual budgets align with and contribute to the implementation of adaptation policies. It should also factor in climate risks and debt sustainability objectives.

Climate-related disasters, like any other types of natural disasters, are an important type of fiscal risk and need to be integrated in fiscal planning and budgeting.

- To this end, the first step is to identify and quantify those fiscal risks. Governments could usefully take stock of public assets exposed to natural hazards, especially those related to critical public services, such as energy, water, transportation, health care, civil protection, and education. The information of asset category, location, and conditions will be then used in quantifying fiscal risks by analyzing the probability and intensity of natural hazards, asset exposure, and the degree of damage to assets due to those hazards. Other sources of climate-related fiscal risks, such as revenue loss or unexpected post-disaster expenditures also could usefully be identified and quantified. To quantify these risks, governments can start with historical analyses of losses from disasters. More forward-looking methodologies can also be deployed because changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, which will impact the channels, likelihood, and magnitude of related fiscal risks.
- Then, the disclosure of climate-related fiscal risks, ideally as part of the overall fiscal risk statement, can help to guide policymakers and the public toward risk-management priorities.
- The last step for ensuring effective fiscal planning and budgeting is to factor these fiscal risks in fiscal planning and make provisions in the budget, including by investing in resilience to reduce risks, by creating fiscal buffers, by ensuring budget flexibilities, and by making risk transfer arrangement to manage residual risks (Cevik and Huang 2018; Gouquet and others 2021; World Bank 2014; IMF 2019b).

Several other PFM tools are available for countries to implement adaptation policies throughout the budget cycle (Gouquet and others 2021). Fiscal authorities can identify critical “entry points” (PFM

² This section was prepared by Ozlem Aydin and Guohua Huang.

processes and tools) to support adaptation objectives. The IMF's Green PFM Framework (Gonguet and others 2021) suggests adjusting PFM processes and tools throughout the budget cycle, from planning to execution and control, to integrate climate considerations (Box 3). Gradual adjustments of existing processes and tools are preferable to creating parallel procedures. Climate change adaptation should be embedded in the medium-term budget and expenditure frameworks for multiyear climate expenditure planning and fiscal reports (including ad hoc reports such as climate budget reports). Other examples include the budget circular, which provides guidance to ministries and agencies on how to link their budget proposals with national priorities, which could include adaptation policies.³ Climate budget tagging has been used by some countries as a tool for tracking and reporting adaptation expenditure (Organisation for Economic Co-operation and Development 2021). External audits can be useful to ensure the quality of these reports as well as government performance on adaptation. Countries can also support the oversight of climate policies by setting up a dedicated independent body. Integrating adaptation policies and measures in PFM processes will likely require changes to countries' PFM legal frameworks.

Box 3. Key Features of the Green Public Finance Management Framework

The IMF's Green Public Finance Management (PFM) Framework explores avenues to adopt green PFM practices across and beyond the budget cycle. This framework essentially relies on the following series of questions:

- Legal framework: Are green PFM practices underpinned by an adequate legal framework?
- Strategic planning and fiscal framework: Do strategic planning tools (national development plan, medium-term fiscal frameworks) take into account green concerns?
- Budget preparation: Are tools in place to integrate climate concerns into (climate impact assessment, tagging of expenditures affecting the environment, green spending reviews) budget preparation and allocation?
- Budget execution and accounting: Is the PFM system able to track and monitor outcomes of green expenditures?
- Control and audit: Are oversight institutions such as supreme audit institutions equipped to analyze and hold to account climate-related expenditures and outcomes?
- Public investment management: Do public investment management choices in terms of planning, allocation of resources, and implementation adequately reflect climate concerns, both in terms of adaptation and mitigation of climate change?
- Fiscal transparency: Are efforts being made to ensure transparency and accountability for environmental aspects all across the budget cycle?
- Coordination with subnational governments and state-owned enterprises: Have PFM practices been adjusted to ensure that these important fiscal actors play a role in the achievement of environmental goals?

Source: Gonguet and others (2021).

Governments would also benefit from mainstreaming climate resilience perspectives in public investment management (PIM) institutions and processes. Climate-sensitive PIM can enhance decision-making on capital projects by ensuring climate risks are robustly assessed and adaptation

³ A budget circular is issued by the central budget agency, includes instructions and policy guidance, and lays out the resource allocations that spending agencies should use for budget formulation.

solutions are systematically considered in project design, appraisal, selection, and implementation. For example, adaptation investments could be based on, among others, solid cost-benefit analysis and social impact assessments with the impact of intensifying climate risks on their results sufficiently considered. The enhancement can help reduce the possibility and consequences of infrastructure disruptions in the aftermath of climate hazards. For all new projects, planning, fund allocation, and implementation can be informed by present and future climate risks. For existing assets, the efficiency of maintenance can improve by factoring in the costs and benefits of increasing resilience to present and future climate hazards. The IMF is developing a climate module for the Public Investment Management Assessment to support member countries in assessing how their PIM systems have integrated climate considerations (Box 4).

Box 4. Climate Public Investment Management Assessment

The Climate Public Investment Management Assessment aims to help governments identify potential improvements in institutions and processes to build low-carbon and climate-resilient infrastructure. The Climate Public Investment Management Assessment is designed around five elements of public investment management that are key for climate-smart infrastructure. It assesses a country's capacity to manage climate-related infrastructure and assesses the following key dimensions of a public investment management framework:

- Climate-aware planning: Is public investment planned from a climate change perspective?
- Coordination between entities: Is there effective coordination of decision-making on climate-change-related public investment across the public sector?
- Project appraisal and selection: Do project appraisal and selection include climate-related analysis and criteria?
- Budgeting and portfolio management: Is climate-related investment spending subject to active management and oversight?
- Risk management: Are fiscal risks relating to climate change and infrastructure incorporated in budgets and fiscal risk analysis, and managed according to a plan?

Source: IMF (2021g).

Project design could be adapted to deal with the deep uncertainties of climate change. Project development can explore the opportunity to delay full implementation of adaptation measures until better information becomes available and/or plan for facilitated future adaptation add-ons, the so-called real options (Le, Leow, and Seiderer 2020; Knudsen and Scandizzo 2011). For example, land could be purchased near an airport to allow for the future runway extensions that could become necessary when higher temperature hampers takeoff. Some tools, such as asset criticality analysis in a network system, stress testing and robust decision-making,⁴ and metrics to capture distributional impacts, can help prioritize adaptation and resilience projects that account for societal benefits and uncertainty (Hallegatte and others 2012; Hallegatte, Rentschler, and Rozenberg 2020). The World Bank has developed a resilience rating system that provides guidance on how to include climate risks into project design and development (Hallegatte and others 2021).

⁴ A robust decision process implies the selection of a project or plan that meets its intended goals across a variety of plausible futures rather than being optimal in any single estimate of the future.

It is critical to address any major PIM weaknesses before embarking on a significant adaptation investment scale-up. PIM weaknesses leading to poor project selection and design, botched construction, or inadequate maintenance are likely to prevent new infrastructure to effectively improve resilience. Analysis shows that, on average, countries waste about one-third of their infrastructure spending due to inefficiencies. The loss can surpass 50 percent in low-income countries (Baum, Mogues, and Verdier 2020). The Public Investment Management Assessment framework can help countries comprehensively assess their PIM practices and design a sequenced reform action plan to improve infrastructure governance (IMF 2015).

The role of finance ministries is critical in ensuring that climate change is reflected in macroeconomic frameworks and adaptation policies are well integrated in budget process.⁵ To achieve these objectives, finance ministries are recommended to closely coordinate with other entities (especially where the climate expertise resides), public corporations, and subnational governments to develop, prioritize, implement, and monitor fiscal measures that can strengthen resilience to future climate risks without hampering the effectiveness of PFM processes.

Capacity development support from the international community could accelerate needed capacity building in PFM. Green PFM practices remain nascent in most countries. The IMF is stepping up its capacity development efforts (green PFM, Climate Public Investment Management Assessment), especially in low-capacity countries, to mainstream climate considerations into PFM processes. Those efforts aim at helping countries to better incorporate adaptation strategies and to better select, design, and implement adaptation programs, thereby helping them make the most of scarce resources. It could also help them meet the requirements for accessing climate funds or climate instruments from multilaterals (Note 2).

⁵ The important role of finance ministries in the climate agenda is recognized with the Coalition of Finance Ministers for Climate Action, launched in April 2019. The coalition endorsed the Helsinki Principles, which promote national, regional, and global action on climate change, especially through fiscal policy and the use of public finance.

Annex 1. Global Progress on National Adaptation Plans

Many countries have found it useful to articulate their adaptation strategies in dedicated documents, known as National Adaptation Plans (NAPs). In 2010, an NAP process was established under the Cancun Adaptation Framework with two objectives in mind: to reduce vulnerability to climate change by increasing adaptive capacity and resilience, and to facilitate the integration of adaptation into new and existing policies, programs, and activities within all relevant sectors. In 2015, the integration of climate change into national policy, including climate change adaptation, became an action target under the climate action Sustainable Development Goals. Some countries include their NAP as part of their national climate change action plans, whereas others choose to develop a separate, more comprehensive, and specific adaptation framework.

We constructed a global database, the adaptation plan tracker, to assess country progress based on the building blocks suggested by the UNFCCC.⁶ The development of adaptation plans by country authorities is recent and remains a work in progress even in most advanced countries. We collected information on 170 countries to create the first comprehensive and detailed assessment of adaptation planning progress, covering countries across continents and levels of development.

This data set was compiled using various sources. The European Commission tracks progress on adaptation policy plans based on a structure that can be mapped to the UNFCCC guidelines. Hence, we drew from the UNFCCC's annually updated publication of measures undertaken in developing countries,⁷ the European Union's semiannually published "Adaptation Preparedness Scoreboard,"⁸ the World Bank's compilation of Nationally Determined Contributions,⁹ the World Bank's Climate Change Knowledge Portal,¹⁰ and the UN Development Programme's Climate Change Adaptation portal.¹¹ We completed missing information from these sources, with independent research using countries' official publications.

The database counts the number of steps taken toward building adaptation plans and addressing the UNFCCC's four planning and implementation steps. The UNFCCC's guidelines are articulated around four main steps, which are themselves divided further in a total of 23 measures (Annex Table 1.1). For the countries that are followed by the UNFCCC, the database counts the number of steps for which at least one measure was completed. For countries covered in the last European Commission's assessment, we use the mapping in Annex Table 1.1 and apply the same methodology: a step is considered taken if at least one submeasure is completed. For the subset of the remaining countries covered in the database, we analyzed published adaptation documents to assess whether at least one measure has been undertaken for each step.

As of 2021, most countries in the world have initiated the NAP process. All but a handful of Middle East countries have taken at least one step toward formulating and implementing their NAPs. According

⁶ See Annex Table 1.1.

⁷ <https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans-naps/documents/supplementary-materials-to-the-information-paper-on-progress-made-in-the-process-to-formulate-and>

⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2018:460:FIN>

⁹ http://spappssecext.worldbank.org/sites/indc/Pages/Content_Brief.aspx

¹⁰ <https://climateknowledgeportal.worldbank.org/>

¹¹ <https://www.adaptation-undp.org/>

to the guidelines, the NAP process should start with the definition of a clear mandate, institutional arrangements, and stakeholder consultations. However, countries that have only taken one step have typically focused on analyzing how climate change may affect communities and the economy (Element B in Annex Table 1.1).

Many countries have made substantial progress, with 104 out of 166 having taken three or more steps. Most countries in the world have produced official documentation as to how climate change may affect their economies and the potential measures needed to combat those effects, and 104 have taken three or more steps toward fully formulating and implementing those plans.

At least 52 countries in the world have published a full-fledged NAP (Annex Table 1.2). These countries span all regions of the world and all income groups, including low-income countries. While the publication of a complete NAP is an important milestone, NAPs are destined to be updated and strengthened as highlighted in the last building block (Element D.4 in Annex Table 1.1).

Future work will focus on expanding the data set coverage and maintaining up-to-date information. The assessment of adaptation progress is complicated when the planning process is decentralized as in the United States and some European countries, or when documents have yet to be translated (for example, Norway). More work is needed to address data collection challenges and improve coverage.

Annex Table 1.1. UNFCCC- and European Commission–Recommended Adaptation Plan Measures

UNFCCC	EU Commission
Element A. Laying the groundwork and addressing gaps	Step A. Preparing the ground for adaptation
1. Initiating and launching the process to formulate and implement national adaptation plans (NAPs)	Coordination structure
2. Submitting proposals for GCF readiness for NAPs	Stakeholders' involvement in policy development
3. Receiving approval for Green Climate Fund readiness funding for NAPs	
4. Formulating a mandate for the process	
5. Defining institutional arrangements and a coordination mechanism	
6. Consulting stakeholders	
7. Synthesizing available information, stocktaking of relevant activities, and assessing gaps and needs	Step B: Assessing risks and vulnerabilities to climate change
8. Developing road maps for the process to formulate and implement NAPs	Knowledge gaps
9. Completed road maps for the process to formulate and implement NAPs	Knowledge transfer
Element B. Preparatory elements	
1. Analyzing past climate and climate change scenarios	Current and projected climate change
2. Comprehensively assessing climate vulnerability	
3. Undertaking activities on integrating adaptation into national and subnational development planning	Step C: Identifying adaptation options
4. Identifying adaptation options to address key vulnerabilities	Identification of adaptation options
5. Appraising, prioritizing, and ranking adaptation options	Funding resources identified and allocated
6. Compiling draft NAPs for consultation and endorsement	
7. Communicating NAPs	
Element C. Implementation strategies	Step D: Implementing adaptation action
1. Designing coherent implementation strategies including synergy	Mainstreaming adaptation in planning processes
2. Prioritizing climate change adaptation in national planning	Implementing adaptation
3. Implementing and managing actions in NAPs to reduce vulnerability and facilitate integration of adaptation into development planning through policies, programs, projects, and other activities	
Element D. Reporting, monitoring, and review	Step E: Monitoring and evaluation of adaptation activities
1. Designing/applying a monitoring and evaluation framework or system	Monitoring and reporting
2. Communicating progress on the process to formulate and implement NAPs	Evaluation
3. Monitoring and periodically reviewing the process	
4. Iterative updating of NAPs	

Sources: European Commission (2018); UNFCCC (2012); and IMF staff consolidation.

Note: Each color block corresponds to a block in the adaptation plan tracker. A country is considered to have taken a step if any of the detailed measures in the block have been completed. GCF = Green Climate Fund; NAP = national adaptation plan; UNFCCC = UN Framework Convention on Climate Change.

Annex Table 1.2. Countries with a Published National Adaptation Plan

Countries	
Albania	Korea
Armenia	Kuwait
Australia	Liberia
Austria	Lithuania
Belgium	Nepal
Brazil	Paraguay
Burkina Faso	Romania
Cameroon	Russia
Canada	Singapore
Chile	Slovak Republic
Colombia	South Africa
Cyprus	Sri Lanka
Czech Republic	St. Lucia
Denmark	St. Vincent and the Grenadines
Estonia	Sudan
Ethiopia	Suriname
Fiji	Switzerland
Finland	Taiwan, Province of China
France	Timor-Leste
Germany	Togo
Grenada	Tonga
Guatemala	Turkey
Hong Kong SAR	United Kingdom
Japan	United States
Kenya	Uruguay
Kiribati	West Bank and Gaza

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

References

- Acevedo, Sebastian. 2014. "Debt, Growth and Natural Disasters: A Caribbean Trilogy." IMF Working Paper 14/125, International Monetary Fund, Washington, DC.
- Agarwal, Ruchir, Vybhavi Balasundharam, Patrick Blagrove, Eugenio M. Cerutti, Ragnar Gudmundsson, and Racha Mousa. 2021. "Climate Change in South Asia: Further Need for Mitigation and Adaptation." IMF Working Paper 21/217, International Monetary Fund, Washington, DC.
- Aligishiev, Zamid, Matthieu Bellon, and Emanuele Massetti. 2022. "Macro-Fiscal Implications of Climate Change Adaptation." IMF Staff Climate Note 2022/002, International Monetary Fund, Washington, DC.
- Baum, Anja, Tewodaj Mogues, and Genevieve Verdier. 2020. "Getting the Most from Public Investment." In *Well Spent: How Strong Infrastructure Governance Can End Waste in Public Investment*, 30–49. Washington, DC: International Monetary Fund.
- Bello, Omar. 2017. "Disasters, Economic Growth and Fiscal Response in the Countries of Latin America and the Caribbean, 1972-2010." *CEPAL Review* 121: 8–29.
- Bellon, Matthieu, and Emanuele Massetti. 2022. "Economic Principles for Integrating Climate Change Adaptation into Fiscal Policy." IMF Staff Climate Note 2022/001, International Monetary Fund, Washington, DC.
- Cantelmo, Alessandro, Giovanni Melina, and Chris Papageorgiou. 2019. "Macroeconomic Outcomes in Disaster-Prone Countries." IMF Working Paper 19/217, International Monetary Fund, Washington, DC.
- Cantelmo, Alessandro, Leo Bonato, Giovanni Melina, Gonzalo Salinas, Sònia Muñoz, and Chris Papageorgiou. 2019. "Policy Trade-Offs in Building Resilience to Natural Disasters: The Case of St. Lucia." IMF Working Paper 19/54, International Monetary Fund, Washington, DC.
- Cebotari, Aliona, Karim Youssef, and Uma Ramakrishnan. 2020. "Natural Disaster Insurance for Sovereigns: Issues, Challenges and Optimality." IMF Working Paper 20/3, International Monetary Fund, Washington, DC.
- Cevik, Serhan, and Guohua Huang. 2018. "How to Manage the Fiscal Costs of Natural Disasters." IMF How-To Note 18/03, International Monetary Fund, Washington, DC.
- Cevik, Serhan, and João Tovar Jalles. 2020. "Feeling the Heat: Climate Shocks and Credit Ratings." IMF Working Papers 20/286, International Monetary Fund, Washington, DC.
- Cevik, Serhan, and João Tovar Jalles. 2021. "An Apocalypse Foretold: Climate Shocks and Sovereign Defaults." *Open Economies Review* 1–20.
- Clarke, Daniel J., and Stefan Dercon. 2016. *Dull Disasters? How Planning Ahead Will Make a Difference*. Oxford: Oxford University Press.
- de Janvry, Alain; Alejandro del Valle, and Elisabeth Sadoulet. 2016. "Insuring Growth: The Impact of Disaster Funds on Economic Reconstruction in Mexico", World Bank Policy Research Working Paper 7714, World Bank, Washington, DC

- European Commission. 2018. *Report From the Commission to the European Parliament and the Council on the Implementation of the EU Strategy on Adaptation to Climate Change*. Brussels: European Commission.
- Gislen, Li, and Alejandro Guerson. 2018. "Strengthening Natural Disaster Resilience: A Saving Fund Proposal." International Monetary Fund, Washington, DC.
- Global Facility for Disaster Reduction and Recovery. 2018. *A Decade of Progress in Disaster Risk Management*. file:///C:/Users/emasseti/Downloads/GFDRR_TENTH_WEB_04262018.pdf
- Gonguet, Fabien, Claude Wendling, Ozlem Aydin, and Bryn Battersby. 2021. "Climate-Sensitive Management of Public Finances-Green PFM." IMF Staff Climate Note 21/002, International Monetary Fund, Washington, DC.
- Government of Grenada. 2021. "Grenada: Disaster Resilience Strategy." Ministry of Finance and Ministry of Climate Resilience paper. St. George's.
- Guerson, Alejandro D. 2020. "Government Insurance Against Natural Disasters: An Application to the ECCU." IMF Working Paper 20/266, International Monetary Fund, Washington, DC.
- Guerson, Alejandro D. 2021. "Optimal State Contingent Sovereign Debt Instruments." IMF Working Paper 21/230, International Monetary Fund, Washington, DC.
- Hallegatte, Stephane, Jun Rentschler, and Julie Rozenberg. 2020. *Adaptation Principles: A Guide for Designing Strategies for Climate Change Adaptation and Resilience*. Washington, DC: World Bank.
- Hallegatte, Stéphane, Ankur Shah, Casey Brown, Robert Lempert, and Stuart Gill. 2012. "Investment Decision Making under Deep Uncertainty—Application to Climate Change." World Bank Policy Research Working Paper 6193, World Bank, Washington, DC.
- Hallegatte, Stéphane, Rubaina Anjum, Paolo Avner, Ammara Shariq, Michelle Winglee, and Camilla Knudsen. 2021. "Integrating Climate Change and Natural Disasters in the Economic Analysis of Projects: A Disaster and Climate Risk Stress Test Methodology." World Bank, Washington, DC.
- Heger, Martin, Alex Julca, and Oliver Paddison. 2008. "Analysing the Impact of Natural Hazards in Small Economies: The Caribbean Case." World Institute for Development Economic Research Paper 2008/25, UN University, New York.
- Hsiang, Solomon M. 2010. "Temperatures and Cyclones Strongly Associated with Economic Production in the Caribbean and Central America." *Proceedings of the National Academy of Sciences* 107 (35): 15367–72.
- International Monetary Fund (IMF). 2015. "Making Public Investment More Efficient." Policy Paper, Washington, DC.
- International Monetary Fund (IMF). 2016. "Small States' Resilience to Natural Disasters and Climate Change—Role for the IMF." IMF Staff Report, Washington, DC.
- International Monetary Fund (IMF). 2018a. "Jamaica: 2018 Article IV Consultation, Third Review Under the Stand-By Arrangement and Request for Modification of Performance Criteria-Press Release and Staff Report." IMF Country Report 103, Washington, DC.

- International Monetary Fund (IMF). 2018b. "Sri Lanka: Selected Issues." IMF Country Report, Washington, DC.
- International Monetary Fund (IMF). 2019a. "Building Resilience in Developing Countries Vulnerable to Large Natural Disasters." IMF Policy Paper, Washington, DC.
- International Monetary Fund (IMF). 2019b. "Eastern Caribbean Currency Union: Selected Issues Paper." Washington, DC.
- International Monetary Fund (IMF). 2020. "Financial Inclusion: What Have We Learned So Far? What Do We Have to Learn?" IMF Working Paper 20/157, Washington, DC.
- International Monetary Fund (IMF). 2021a. "Climate Change Challenges in Latin America and the Caribbean." In *Regional Economic Outlook: Western Hemisphere—A Long and Winding Road to Recovery*. Washington, DC, October.
- International Monetary Fund (IMF). 2021b. "Costa Rica: 2021 Article IV Consultation and Request for an Extended Arrangement Under the Extended Fund Facility Staff Report." IMF Country Report 048, Washington, DC.
- International Monetary Fund (IMF). 2021c. "Dominica: Disaster Resilience Strategy." IMF Country Report, Washington, DC.
- International Monetary Fund (IMF). 2021d. "Honduras: Fourth Reviews Under the Stand-by Arrangement and the Arrangement Under the Standby Credit Facility, Requests for Augmentation of Access, Extension and Rephrasing of the Arrangements, and Waivers of Nonobservance of Performance Criteria-Press Release." IMF Staff Report, Washington, DC.
- International Monetary Fund (IMF). 2021e. "IMF Strategy to Help Members Address Climate Change Related Policy Challenges—Priorities, Modes of Delivery, and Budget Implications." IMF Policy Paper, Washington, DC /21/057.
- International Monetary Fund (IMF). 2021f. "Introducing Mandatory Property Insurance in The Bahamas: 2020 Article IV Consultation Staff Report." IMF Country Report , Washington, DC.
- International Monetary Fund (IMF). 2021g. "Strengthening Infrastructure Governance for Climate-Responsive Public Investment." IMF Policy Paper, Washington, DC.
- Knudsen, Odin K., and Pasquale L. Scandizzo. 2011. "Real Options and Project Evaluation." World Bank Working Paper 62487, World Bank, Washington, DC.
- Le, Tuan Minh, Wei-Jen Leow, and Fabian Seiderer. 2020. "Building Resilience in Infrastructure to Climate Change." In *Well Spent: How Strong Infrastructure Governance Can End Waste in Public Investment*, 282–300. Washington, DC: International Monetary Fund.
- Lian, W., J. R. Moran, and R. Vishvesh. Forthcoming. "Natural Hazards, Disasters, and Scarring Effects." IMF Working Papers, International Monetary Fund, Washington, DC.
- Melina, Giovanni, and Marika Santoro. 2021. "Enhancing Resilience to Climate Change in the Maldives." IMF Working Paper 21/96, International Monetary Fund, Washington, DC.
- Nachmany, Michal, Rebecca Byrnes, and Swenja Surminski. 2019. "Policy Brief: National Laws and Policies on Climate Change Adaptation: A Global Review." London School of Economics, Grantham Research Institute on Climate Change and the Environment, London.

- Organisation for Economic Co-operation and Development (OECD). 2021. "Climate Change and Long-Term Fiscal Sustainability." Paris.
- Paris Agreement. 2015. "Report of the Conference of the Parties to the United Nations Framework Convention on Climate Change (21st Session, 2015: Paris)." Paris.
- Pielke, R. 2018. "Tracking Progress on the Economic Costs of Disasters under the Indicators of the Sustainable Development Goals." *Environmental Hazards* 18 (1): 1–6.
- Rasmussen, Tobias N. 2004. "Macroeconomic Implications of Natural Disasters in the Caribbean." IMF Working Paper 04/224, International Monetary Fund, Washington, DC.
- Strobl, Eric. 2012. "The Economic Growth Impact of Natural Disasters in Developing Countries: Evidence from Hurricane Strikes in the Central American and Caribbean Regions." *Journal of Development Economics* 97 (1): 130–41.
- United Nations Environment Programme. 2021. *Adaptation Gap Report 2021: The Gathering Storm – Adapting to Climate Change in a Post-Pandemic World*. Nairobi, Kenya.
- United Nations Framework Convention on Climate Change (UNFCCC). 2012. "National Adaptation Plans: Technical Guidelines for the National Adaptation Plan Process." Bonn, Germany.
- World Bank. 2014. *Financial Protection Against Natural Disasters: An Operational Framework for Disaster Risk Financing and Insurance*. Washington, DC: The World Bank Group.
- World Bank. 2021. "Climate Change Institutional Assessment. Equitable Growth, Finance and Institutions Notes." Washington, DC.



PUBLICATIONS

Planning and Mainstreaming Adaptation to
Climate Change in Fiscal Policy

IMF STAFF CLIMATE NOTE 2022/003

ISBN 979-8-4002-0195-0



9 798400 201950