TASK FORCE ON CLIMATE, DEVELOPMENT AND THE INTERNATIONAL MONETARY FUND

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Room to Grow

Integrating Climate Change in Debt Sustainability Analyses for Low-Income Countries

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About the Task Force on Climate, Development and the International Monetary Fund

The Task Force on Climate, Development and the International Monetary Fund is a consortium of experts from around the world utilizing rigorous, empirical research to advance a development-centered approach to climate change at the IMF. The Task Force believes it is imperative that the global community support climate resilience and transitions to a low-carbon economy in a just manner. As the only multilateral, rules-based institution charged with promoting the stability of the international financial and monetary system, the IMF has a vital role to play in supporting a globally coordinated response.

MEMBER ORGANIZATIONS

- Intergovernmental Group of Twenty-Four (G24)
- Vulnerable Group of Twenty (V20) Ministers of Finance
- African Center for Economic Transformation
- African Economic Research Consortium
- Boston University Global Development Policy Center
- Centre for Policy Dialogue
- Centre for Social and Economic Progress
- Financial Futures Center
- Macro & Green Finance Lab, National School of Development, Peking University
- United Nations Economic Commission for Latin America and the Caribbean

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On left, Cap Haitien, Haiti. Photo by Ievgenii Bakhvalov via Shutterstock.

Meet the Members of The Task Force

JOHN ASAFU-ADJAYE is a Senior Fellow at the African Center for Economic Transformation (ACET).

SARA JANE AHMED serves as Managing Director and Finance Advisor to the Vulnerable Group of Twenty (V20) Ministers of Finance of the Climate Vulnerable Forum (CVF).

RISHIKESH RAM BHANDARY is Assistant Director of the Global Economic Governance Initiative at the Boston University Global Development Policy Center.

AMAR BHATTACHARYA is a Senior Fellow in the Center for Sustainable Development at the Brookings Institution and a Visiting Professor in Practice at the Grantham Research Institute at the London School of Economics.

KEVIN P. GALLAGHER is a Professor of Global Development Policy at Boston University's Pardee School of Global Studies and Director of the Boston University Global Development Policy Center.

XIAOBEI HE is Deputy Director of the Macro and Green Finance Lab at the National School of Development, Peking University.

MA JUN is Director of the Macro and Green Finance Lab at the National School of Development, Peking University, and the Founder and President of Institute of Finance and Sustainability in Beijing. He is the President of Institute of Finance and Sustainability and Co-Chair of the G20 Sustainable Finance Working Group, and he served as the Chief Economist at the People's Bank of China's Research Bureau.

ABBI KEDIR is the Director of Research at the African Economic Research Consortium.

FAHMIDA KHATUN is the Executive Director of the Centre for Policy Dialogue (CPD), a leading think tank in Bangladesh and South Asia.

IYABO MASHA is Director of the Intergovernmental Group of Twenty-Four on International Monetary Affairs and Development.

RAKESH MOHAN is President and Distinguished Fellow at Centre for Social and Economic Progress. He served as Executive Director on the Board of the International Monetary Fund. He was Deputy Governor of the Reserve Bank of India between 2002-2009.

IRENE MONASTEROLO is Professor of Climate Finance at the Utrecht University School of Economics and a Non-resident Fellow with the Global Economic Governance Initiative at the Boston University Global Development Policy Center.

DIANAH NGUI MUCHAI is a Collaborative Research Manager at the African Economic Research Consortium.

JANAK RAJ is a Senior Fellow at Centre for Social and Economic Progress.

JWALA RAMBARRAN is a Senior Advisor at Financial Futures Center and Distinguished Fellow at the Climate Works Foundation. He is the former Governor of the Central Bank of Trinidad and Tobago.

DANIEL TITELMAN is the Director of the Economic Development Division at the United Nations Economic Commission for Latin America and the Caribbean.

MARILOU UY is a Non-resident Senior Fellow with the Global Economic Governance Initiative at the Boston University Global Development Policy Center.

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EXECUTIVE SUMMARY

Developing countries need to invest heavily to transform their economies to achieve sustainable development and address climate change, but they are falling behind in the shift to clean energy, enhancing adaptation and resilience, addressing loss and damage, and restoring nature.

To meet these policy goals, debt sustainability analyses (DSAs) conducted by the International Monetary Fund (IMF) will need to recognize the long-term financing requirements by developing countries to invest at the levels needed to address climate change and build resilience to shocks.

The DSA serves two major functions. First, the DSA provides an assessment of the debt sustainability risks faced by the country. It quantifies the available "fiscal space" for additional borrowing conditional on a sustainable debt burden. Second, the DSA helps to inform debt restructuring needs when countries undertake debt treatment.

Integrating climate change considerations into DSAs for low-income countries (LICs) is critical given the increasing frequency and severity of climate-related shocks, the macro-critical nature of climate change, and the structural transformation required to pursue climate resilient growth paths. Climate-sensitive DSAs could play a key role in highlighting the challenges posed by climate change on countries' fiscal and financial stability, and the opportunity space to invest in climate mitigation and adaptation to support economic growth, build resilience, and preserve fiscal and financial stability.

In order to do so, however, DSAs need to be fit-for-purpose. This policy brief provides actionable insights to improve the IMF/World Bank Debt Sustainability Framework for Low-Income Countries (LIC DSF) to guide climate-related investment decision-making in LICs, with a view to support growth and mobilize investments in a fiscally sound and financially stable manner. These evidence-based insights inform the integration of climate risk into the DSA's modeling framework that is consistent with the state-of-the-art in climate economics and finance. The findings from this policy brief are informed by discussions at a January 2024 workshop hosted by the Task Force on Climate, Development and the IMF on the LIC DSF.

Key Policy Recommendations

1. **The IMF and World Bank should integrate climate risks in the LIC DSF by enhancing its methodology in four areas.**

    - **Data.** The granularity of the data collected for climate risks, including geolocation and production activity (for physical climate risks) and data complementary to greenhouse gas emissions such as energy technologies (for transition risks), needs to be improved. The data challenge is acute in the area of climate finance

flows in LICs, which limits the reliability of any analysis and resulting evidence that attempts to highlight the macro-critical aspect of these flows.

- **Scenarios.** The LIC DSF methodology should utilize the latest generation of climate risk scenarios, identify packages of grants and concessional finance needed for climate investments, introduce realism regarding private finance mobilization by considering fiscal and financial risks, and the IMF and World Bank should actively contribute to scenario development by tailoring them to country characteristics. Scenarios should also consider the compounding losses from climate risks, including transition risks and cross-boundary spillover risks, and other shocks and the benefits of early action. How climate damages impact the creditworthiness of countries and interest rates is also a crucial consideration.

- **Macro-financial model.** The IMF and World Bank should complement existing macroeconomic models with models that depict analytically important characteristics of climate risks such as non-linearity, deep uncertainty and endogeneity, the persistent impact of shocks on variables including fiscal outlays, and feedback effects that amplify shocks.

- **A risk management approach.** Such an approach should be adopted in assessing the fiscal and financial impacts of climate risks.

2. **The IMF and World Bank should revise the LIC DSF to reflect the importance of an investment-led growth path for low-income countries.**

    - The DSA should identify pathways for the government to increase investment in ways that maintain fiscal sustainability such as through grants, concessional finance and debt relief. The pathways should be consistent with the rule of thumb of maintaining the cost of capital below medium-term projected economic growth rates to minimize fiscal and financial risks. The pathways need to go beyond automatically triggering fiscal consolidation as the sole option. IMF and World Bank should collaborate to build capacity and partnerships.

    - The LIC DSF methodology needs to incorporate climate investments into the analysis and identify scenarios that reflect the full scale of climate investments required to achieve the country's climate change goals. The methodology should also analyze how climate investments enhance growth and reduce sovereign risk. A risk management approach should be central to the scenario analysis to fully recognize the benefits of climate investments which otherwise have not been fully accounted for in cost benefit analyses.

    - The IMF and World Bank should make 20-year time horizons in DSAs standard practice to ensure that the longer term implications of climate change and investments are captured in the analysis.

3. **The IMF and World Bank should collaborate to build capacity and partnerships.** In particular, the IMF should capitalize on the World Bank's longstanding work on public sector investment programs and knowledge of country-specific drivers of long-term growth and how climate risks shape national development outcomes through their country climate development report diagnostics. Collaboration on capacity building will

also be important to improve data collection which will ultimately improve the quality of the DSA.

CLIMATE INVESTMENT NEEDS AND DEBT SUSTAINABILITY CHALLENGES FOR LOW-INCOME COUNTRIES

Developing countries need to invest heavily to transform their economies to achieve sustainable development and address climate change. The 2023 Report of the Independent High-Level Expert Group on Climate Finance shows that climate investments are lagging in developing countries (Bhattacharya et al. 2023). They are falling behind in the shift to clean energy, in enhancing adaptation and resilience, in addressing loss and damage, and in restoring nature.

Boosting investments will depend critically on the availability of adequate and affordable finance. Developing countries (outside of China) will need to mobilize massive financial resources to boost investments to fill an estimated climate financing gap of $3 trillion annually by 2030, of which $1.2 trillion is expected to come from external finance (Songwe, Stern and Bhattacharya 2022). Debt sustainability analyses (DSAs) will need to recognize the long-term financing requirements by developing countries to invest at the levels needed to address climate change and build resiience to shocks.

The International Monetary Fund (IMF)'s Fiscal Monitor in 2023 showed that elevated public debt levels and limited fiscal resources complicate the ability of emerging and developing economies to carry out investments to manage climate risks and other external shocks (IMF 2023). Under current financing conditions, increasing public climate investments in many emerging and developing countries substantially could increase risks to debt sustainability and sovereign financial stability (Gourdel et al. 2022). Kharas and Rivard (2023), however, demonstrated that scenarios associated with a "big investment push" translate to higher income levels in the long-term than a business-as-usual scenario of fiscal consolidation. While indebtedness also increases, if the big push is undertaken with the support of affordable financing, the impact on creditworthiness may not be deleterious, highlighting the importance of enhancing access to affordable finance. Moreover, Cevik and Jalles find that an increase in climate vulnerability decreases country creditworthiness so that an investment push that also increases spending to build resilience will improve growth prospects and creditworthiness. Unfortunately, many low-income countries (LICs) and small climate vulnerable states have large adaptation needs but do not have the fiscal and borrowing space to invest (Chamon et al. 2022). They face a difficult dilemma of whether to invest and risk undermining their debt sustainability, or not investing and leaving themselves further exposed to climate risks (UNCTAD 2022). Research also shows that climate investments, especially related to adaptation, lower sovereign risk thereby lowering the cost of capital (Task Force 2022).

A core challenge facing LICs is transforming their economies in a manner that enables them to achieve their development goals. The type of structural transformation will vary depending on national contexts and circumstances (Gallagher and Bhandary 2023). The IMF's policy advice has largely focused on carbon pricing as the main instrument to mitigate climate change and raise financing to support the low carbon transition (see Task Force 2023). The introduction of carbon prices has been very difficult politically in many countries, so that its global coverage has been very limited so far. While the rationale of pricing externalities is sound, in light of the multiple and major market failures, technological changes and the need for systemic shifts, a

broader focus on investment mobilized through multiple instruments will be required (Stern et al. 2022).

One of the main instruments used by the IMF for surveillance purposes and program lending is the DSA. Given the distinct set of challenges faced by countries with and without access to international capital markets, the IMF has two separate tools to reflect these two different contexts. LICs primarily access concessional finance for their external financing needs which the IMF/World Bank Debt Sustainability Framework for Low-Income Countries (LIC DSF) captures. A separate tool – the Sovereign Risk and Debt Sustainability Framework for Market Access Countries – is used for countries that access international capital markets.

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As part of the ongoing effort to reform the IMF/World Bank Debt Sustainability Framework for Low-Income Countries (LIC DSF), the IMF/World Bank issued the "Supplement to the 2018 Guidance Note on the Bank-Fund Debt Sustainability Framwork for Low-Income Countries" in August 2024 (referred to as the "2024 Supplement") (IMF 2024). The 2024 Supplement provides additional guidance on the inclusion and treatment of climate change in the LIC DSF methodology. This is an important step toward systematically incorporating climate risks in DSAs. This policy brief reflects on approaches to support such effort, drawing on the research of the Task Force on Climate, Development and the IMF (henceforth the Task Force) and the scholarship more broadly on how the World Bank and the IMF could enhance the DSA's methodology and analytical approach. It draws from the discussions at the LIC DSF Workshop held by the Task Force in January 2024.

This policy brief focuses on how to reshape the LIC DSF to reflect the combined effect of climate and other external shocks on growth and debt sustainability. It proposes methodologies to integrate climate risks in DSAs so they can better inform sovereign risk assessments and resource mobilization pathways for investments to catalyze sustainable growth. In addition, it suggests collaborative approaches to leverage expertise elsewhere and promote country engagement so that DSAs provide a strong foundation for policymaking, IMF programs and, if needed, debt restructuring.

INTEGRATING CLIMATE RISKS IN DSA METHODOLOGIES: CHALLENGES AND OPPORTUNITIES

Recognizing the relevance of climate risks for economic development and financial stability, the IMF has been integrating climate risks in its surveillance toolkit as part of its Climate Change Strategy (IMF 2021). Article IV consultations have increasingly covered climate policies (e.g., carbon pricing) and natural disasters risks. Furthermore, the IMF's Financial Sector Assessment Program (FSAP) has begun incorporating the impact of climate change on banking sector stability in its assessments.

Nevertheless, the IMF's methodological approach to assess the macro-financial relevance of climate risks should further improve in order to effectively inform the integration of climate risks in bilateral surveillance instruments, including in DSA.

The Task Force's preliminary assessment of progress made by the IMF on its Climate Change Strategy proposed more robust assessments of climate-related financial risks at the country and regional levels to better inform risk assessment and management (Task Force 2023). Catastrophe modeling plays a critical role in obtaining reliable loss and damage estimates and estimating the overall costs of climate disasters.

Such a modeling method gives quantitative insights into the potential impact of both natural disasters and extreme weather events, and it has been widely used by the insurance industry. By using large time series data, and granular information on the localization of socio-economic activities at risk, catastrophe models translate damage functions into estimates of potential losses. This information, in turn, is important to assess and manage risk exposure and to develop resilience strategies. The insights from such models help policymakers in LICs to prioritize investments in infrastructure, emergency preparedness and resilience to mitigate the impacts of climate-related disasters. Overall, robust climate change projections improve climate risk modeling (Jewson 2022).

The limits of existing DSA methodologies are well-documented (see e.g., Cömert et al. 2024). In particular, the economic growth estimates, which then inform the fiscal and monetary policy responses, have been criticized for being too optimistic, often significantly so (World Bank 2023; Raga 2024). On the one hand, DSAs do not consider the persistency of the impacts of shocks on growth and debt levels, largely due to the macroeconomic modeling chosen. The IMF uses macroeconomic models that by construction are not able to consider the persistency of a shock on the level of gross domestic product (GDP) and factor in the need to anchor investors' expectations to preserve LICs' access to markets.

On the other hand, DSAs have overestimated the growth potential of fiscal consolidation as well as prospective revenue increases and debt reduction over time (Guzman and Heymann 2015; Raga 2024), while underestimating the growth potential from public investments (i.e., underestimating the co-benefits of public investments emerging from positive multipliers). These contribute to DSAs underestimating the financing needs to meet the climate goals. More fundamentally, the treatment of money supply as exogenous rather than endogenous to economic activity in the modeling approach contributes to the over-optimistic growth effects of fiscal consolidation.

Forecast errors tend to be higher for LICs relative to middle-income countries and to be wider in range amid overlapping shocks (Raga 2024). This is particularly relevant in the context of LICs where non-climate related shocks (e.g., debt, pandemics) already compound climate-related shocks, such as natural disasters (Ranger, Mahul, and Monasterolo 2021), leading to a shock persistency preventing the economy to recover fully in the short term. This, in turn, has major implications on countries' fiscal and debt positions, and thus on their ability to borrow in international markets (Dunz et al. 2023).

An increasing number of DSAs have begun to underscore the need to take in to account the macro-critical impacts of natural disaster risks on growth projections and to conduct stress tests for countries vulnerable to natural disasters. This is a welcome and much needed step forward. The IMF needs to expand its focus to include shocks beyond natural disasters such

as transition risks (as identified by Network for Greening the Financial System (NGFS)) and spillover risks (as identified by the Task Force) and ensure that these shocks are captured using fit for purpose and scientifically sound models (Gourdel, Monasterolo and Gallagher 2022; Network for Greening the Financial System 2021).

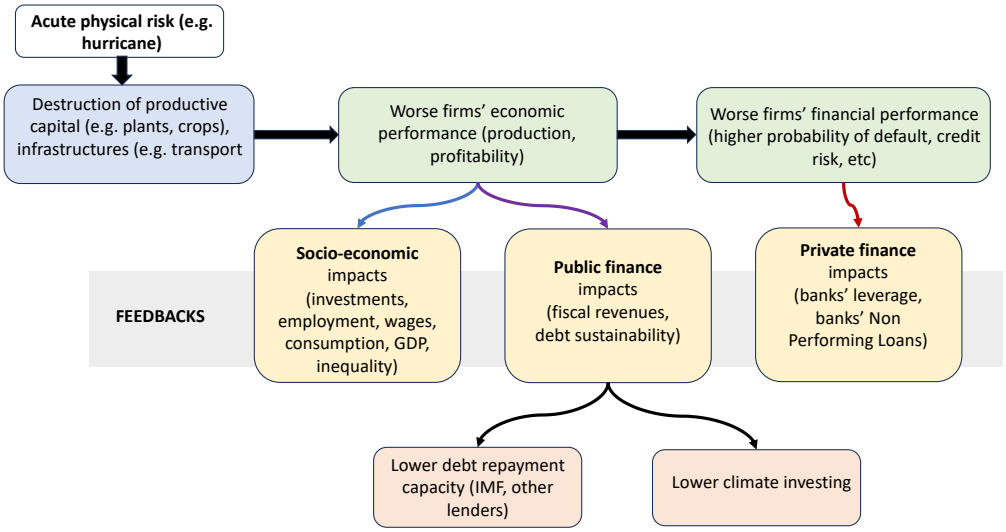
In particular, key areas of intervention include the use of climate scenarios; data granularity and relevance in the country context (considering climate risks exposure, business and financial characteristics); the risk transmission channels to economic and financial activities, considering LIC specificity; and the macroeconomic and financial modelling of climate risk.

Identifying Macro-Financial Climate Risk Transmission Channels

Figure 1 identifies climate-related physical risks and their direct, indirect and spillover transmission channels to the economy and financial conditions, considering the drivers of countries' exposure to climate risks. *Climate physical risk* refers to the impacts of climate change on firms' activities (e.g., destruction of productive plants), business performance and, through that, on the value of firms' financial assets and investors' portfolios. Physical risks can include (i) *acute* risks, such as from floods, droughts and hurricanes, which impact the economy and finance in the short-term and (ii) *chronic risks* which include slow unfolding events such as temperature increase, sea-level rise and biodiversity loss (NGFS 2019). For example, a hurricane that significantly damages a firm's productive plants and the nearby infrastructures will impair firms' profitability and could even lead to bankruptcy if the affected plants are a core part of the firm's business. The economic loss then translates to a financial loss arising from a negative adjustment in the value of financial assets (e.g., stocks, bonds) and/or an inability to repay outstanding loans that eventually affects investors directly (Battiston and Monasterolo 2024). If these activities have liability cover, e.g., insurance, then insurance (and reinsurance) firms could also suffer from larger claims (Monasterolo 2020a).

The Intergovernmental Panel on Climate Change (IPCC)'s 2022 report shows the substantial damages and losses from worsening extreme and slow onset climate related events, which impact lower income and climate-vulnerable countries disproportionately (IPCC 2022). Acute physical risks are worrisome for several LICs, and their impacts are expected to escalate. Indeed, recent weather projections for 2024/25 on the transition to El Niño to La Niña, portends more intense hurricanes with potentially devastating impacts in some countries especially if adequate investments in adaptation are not made (World Metereological Organization 2024).

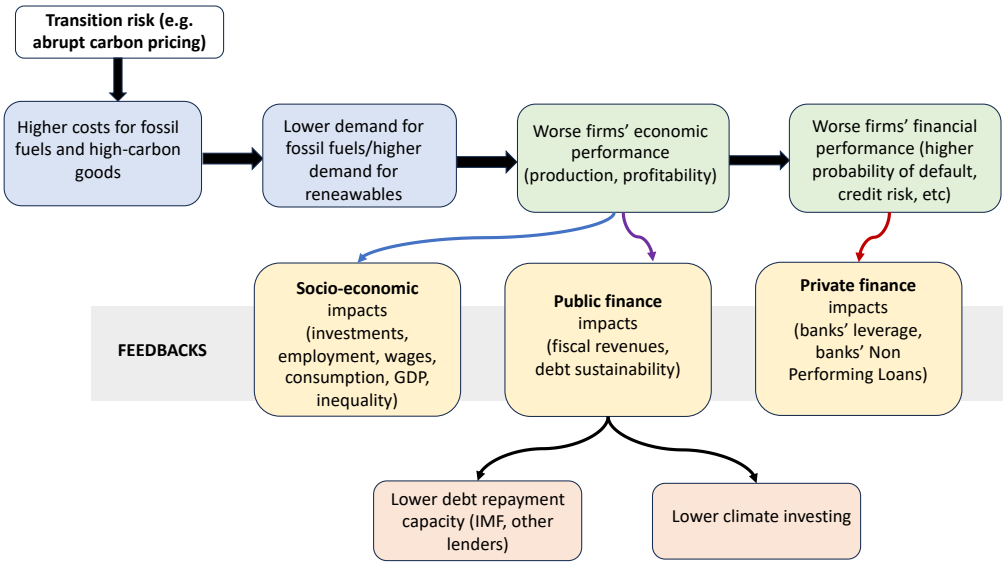
FIGURE 1: RISK TRANSMISSION CHANNELS FROM PHYSICAL RISK TO THE ECONOMY, PUBLIC AND PRIVATE FINANCE, DEBT REPAYMENT AND CLIMATE INVESTING CAPACITY



Source: Gourdel and Monasterolo (2022).

Note: Blue boxes: shock entry point in the economy. Green boxes: direct impacts. Yellow boxes: indirect impacts. Orange boxes: cascading impacts on creditors.

FIGURE 2: RISK TRANSMISSION CHANNELS FROM CLIMATE TRANSITION RISK TO THE ECONOMY, PUBLIC AND PRIVATE FINANCE, DEBT REPAYMENT AND CLIMATE INVESTING CAPACITY



Source: Gourdel and Monasterolo (2022).

Note: Blue boxes: shock entry point in the economy. Green boxes: direct impacts. Yellow boxes: indirect impacts. Orange boxes: cascading impacts on creditors.

Climate transition risks, in contrast, refer to the impacts on firms' performance and, through that, on the value of firms' financial assets and investors' portfolios, induced by a sudden change in the climate policy and regulatory environment, such as a late and sudden introduction of a carbon tax, environmental regulation, technological shocks or changes in consumers' preferences, such as for low-carbon goods (NGFS 2019). For instance, introducing a carbon tax would lead to larger costs and lower profits for firms that extract, produce or use fossil fuels for their business. A depreciation of fossil fuel assets, known as carbon stranded assets, could follow and influence the adjustment of the valuation of assets issued by high-carbon firms. The economic loss will translate then in a financial loss, whereby the loss in firm's performance translates to a negative adjustment to financial assets or an inability to repay outstanding loans, affecting investors (Battiston and Monasterolo 2024).

Both acute physical risk and transition risk could happen in the short term (i.e., before 2030). On the one hand, several developing countries and emerging economies are already experiencing the impacts of hazards. On the other hand, market sentiments (investors' expectations about climate risk and policy credibility) could change abruptly as a result of incoming new information, leading to a larger volatility in prices of assets and capital flows (Monasterolo 2020).

Finally, *transition spillover risks* pertain to the cross-border macro-critical impacts of the climate transition. The introduction of climate policies in one country can lead to negative spillover effects on a commercial partner country that exports fossil fuels. Carbon pricing would lead to a decline in demand for fossil fuels from the country in which it is introduced, thus leading to adjustments in the balance of payment of the exporting country, with implications on fiscal budget and public debt, if the export of fossil fuels play an important role for the economy. For instance, Gourdel et al. (2022) analyzed the impact of climate transition spillover risk in Indonesia, resulting from the introduction of carbon pricing in China conditioned to the NGFS scenarios. Results show that lower Chinese demand for Indonesian coal would negatively affect the balance of payment of Indonesia, given the relevance of the coal industry for the Indonesian economy, leading to impairments in fiscal budgets and an increase in public debt (Gourdel et al. 2022).

Reforming Methodologies to Integrate Climate Risks in DSAs

DSAs would benefit from a stronger reliance on the state of the art assessment of climate risks, complementing the suite of macroeconomic models used with those that are able to capture the characteristics of climate risks (e.g. non-linearity, tipping points and endogeneity) (Battiston and Monasterolo 2024) and consider the role of different types of climate policies in discussion and implementation (that is, not only fiscal, but also monetary and prudential), and avoiding simplistic assumptions. This, in turn, would contribute to improve DSA in at least three ways.

First, it would provide more realistic, climate risk scenarios-conditioned growth projections, considering the magnitude and persistency of impacts, both in the economy and finance, and their drivers, increasing transparency regarding the transmission channels of shocks.

So far, DSAs calculate the impacts of climate risks on growth projections either by relying on past disaster risk data (e.g., the EMDAT for Comoros (2021), Solomon Islands (2021), Tonga (2021) and Haiti (2019)'s DSA). The 2024 Supplement has recommended using

historical data where a stand-alone climate change macro model or in-depth climate analysis is not available. However, it is now recognized that this approach leads to underestimating the potential impact of future climate change on growth because climate risks are forward looking and characterized by non-linearities, deep uncertainties (Steffen et al. 2018) and tipping points (Lenton et al. 2021), meaning that the future climate risk and its socio-economic impacts, could differ considerably from the past. Thus, using historical data (e.g. on disasters' occurrence, disasters' losses or greenhouse gas (GHG) emissions) to calculate future losses would lead to a very imprecise assessment of risk. This is why the IPCC as well as the NGFS recommend assessing climate risks in the economy and finance using scenarios (see e.g., NGFS 2020, 2023).

More recently, the IMF has started to rely on the World Bank's Country Climate and Development Reports (CCDRs), which are based on the World Bank's macroeconomic and fiscal model (MFMod [1]) that has incorporated a forecasting instrument that can simulate a range of climate and policy scenarios. In the neoclassical tradition, these minimum-value at risk (min-var) intertemporally optimizing models typically assume (i) long run equilibrium, (ii) rational, forward-looking expectations and (iii) representative agents and sectors that hardly distinguish between high and low-carbon technology and inputs, and adaptation investments. For these reasons, these models struggle to represent the non-linearity and deep uncertainty inherent in climate risks, and they fail to adequately account for the endogeneity of climate change—that is, the feedback loops where economic decisions impact climate outcomes, which in turn affect the economy. These characteristics limit the ability to capture the full magnitude of a climate shock on growth and its persistency, and potential feedbacks, over time. As discussed above, physical and transition risks are macro-critical and their interactions need to be accounted for as well. DSAs should incorporate these risks into the analytical model so that damages can be more accurately calculated (alongside the benefits of early action).

As growth projections play a key role in DSA, strengthening their assessment across climate scenarios will improve the quality of debt sustainability assessments. With strengthened collaboration with the World Bank, more work should be done to identify the country-specific determinants of medium- and long-term growth, and how climate risks impact on such determinants. These can then inform estimates of prospective revenue gains and debt levels conditioned to climate scenarios (e.g. of orderly or disorderly transition).

Second, it would properly capture the role of co-benefits from early climate policy action (consistent with orderly transition scenarios narratives). The co-benefits could include health benefits, energy access, nature and beyond. This, in turn, would help understand under which conditions green fiscal multipliers from climate investments could emerge (Batini et al. 2022) and to assess them in an evidence-based manner. Corresponding to the climate risks discussed in the section above, an evaluation of possible fiscal responses to prospective shocks would also shed light on the resulting debt trajectories. The DSAs should provide clarity on how climate risks impact fiscal outlays. Indeed, economic models built either on general or on a partial equilibrium fail to capture the co-benefits of early climate action on the transition, e.g., in terms of structural change in the economy, labor market and greening of finance. They neglect the role of money and or financial institutions (e.g. a bank) that decide whether to

[1] MFMOD is rooted on general equilibrium, and features - as in the neoclassical tradition - an aggregate production function, utility maximizing, fully rational, representative agents (household subject to budget constraints, cost minimizing firms).

finance firms' investments in, for example, high- or low-carbon technologies, based on their financial risk assessment (Battiston et al. 2021). This means that the models describe a world where a representative firm can make investments without credit constraints. In reality, however, credit constraints represent an important barrier to firms' investments, in particular for small- and medium-sized enterprises. Thus, such models do not consider features that are key to the problem under examination, namely climate investments in the low-carbon transition. By neglecting the role of finance, they do not allow for considering macro-financial feedback loops (including possible second round effects from financial sector players) and their impact on both debt sustainability, and on the transition.

Third, it would better inform monetary policies and macroprudential regulations. The models adopted so far in DSAs consider only real variables, thus preventing the analysis of other-than-fiscal type of policies such as monetary policies, that work via the interest rate channel (which in turn is crucial in affecting the cost of capital for low-carbon technologies), or prudential policies that regulate investors' capital requirements. Climate damages, however, do affect the interest rate and this relationship needs to be accounted for in the DSA. Likewise, climate policies affect firms and investors' incentives (e.g., by changing costs of investments), and evidence shows that even the announcement of climate policies could lead to a revision in market prices and investment decisions (Monasterolo and De Angelis 2020; Ramelli, Ossola, and Rancan 2021; Alessi, Battiston, and Kvedaras 2024). These multipliers will show the value of investing for climate resilience and highlight potential opportunities to mobilize financial resources to alleviate fiscal constraints. As the IMF integrates the monetary-financial aspects of climate risk in its FSAPs, greater synergy between DSAs and FSAPs would also be necessary.

These are important limitations to the policy relevance of the current DSA and also climate stress test exercises.

Against this background, we identify four areas in which DSAs should strengthen their methodological approaches to assess climate risks on the economy and financial conditions of LICs, in ways that consider the regional and national characteristics of exposure, i.e., granularity and relevance of data; climate scenarios; macro-financial models.

DATA

The granularity of data collected for climate risk exposure should be increased, from the current sector (or aggregate firm level) to the asset-level, considering:

- For physical risk, the *geolocation and type of production activity*. Indeed, most DSAs rely on sectoral impacts of shocks, or firm level aggregated information. However, increasing the granularity of information is crucial to avoid a large underestimation of losses from physical risk (up to 80 percent of investors' portfolios (Bressan et al. 2024)).
- For transition risk, complement GHG emissions information with information that is less prone to greenwashing and poor reporting, such as the energy technology profile and business model (input substitutability) (Battiston et al. 2017). Indeed, sectoral (and even firm level) aggregates usually hide large heterogeneity in the contribution to GHG emissions, and thus the exposure to transition risk of assets (Bressan et al. 2022).
- To evaluate the impact of climate investments on fiscal and debt position, disaggregated data on climate finance flows related to LICs (e.g. mitigation grants and loans; adaptation

grants and loans) is largely missing thereby making the macro-critical analysis challenging (Adetutu et al. forthcoming).

CLIMATE MITIGATION SCENARIOS

The NGFS – which includes over 130 central banks and financial regulators – recommended the use of climate scenarios for climate economic and financial risk assessment in a forward looking way (NGFS 2020). The NGFS also co-developed with the scientific community (the process-based Integrated Assessment Models) climate scenarios that investors and NGFS members are recommended to use for climate stress tests. In this regard, the LIC DSF would benefit from integrating the latest generation of climate scenarios, in the climate risk assessments, and contribute to their development in collaboration with the World Bank, e.g. by tailoring them to countries' characteristics, supported by data collection and standardization (e.g., of losses from disasters). Scenarios should reflect not just physical climate risks and transition risks but also their interactions, cascading impacts, and negative spillovers from climate change and climate policies.

Scenarios should integrate the compounding of climate risks with other types of shocks, such as pandemics, debt crises and biodiversity loss. Neglecting loss correlation and tail risk driven by that results in an optimistic estimation of the ability of countries to recover.

The guidance note for the Resilience and Sustainability has recommended a 20-year horizon in the LIC DSF (IMF 2023b). This long-term time horizon is a welcome step and should be considered to enhance the standard LIC DSF methodology.

MACRO-FINANCIAL MODELS

The models used to integrate climate into DSAs tend to smooth the magnitude of climate-related losses and their persistency on GDP growth levels, and neglect the distributive effects within countries. To overcome this limitation, the IMF should consider complementing its macroeconomic models with models that allow for considering the following: (i) the characteristics of climate risks (i.e. non-linearity, deep uncertainty, endogeneity, heterogeneity), (ii) the persistence of shocks in the economy and its drivers, (iii) the macro-financial feedbacks that could amplify the shock and increase the costs and time of the recovery and (iv) the need to increase the spatial and sectoral resolution of climate impact assessments within DSA models.

This can be done by using data and models that capture variations in climate impacts across different regions and economic sectors within countries. For instance, agricultural areas, urban areas and pastoral regions face varied climate risks, and this heterogeneity needs to be considered. Models based on equilibrium, minimum-maximum (min-max) intertemporal optimization and rationale expectations can easily lead to an underestimation of GDP losses and of the co-benefits of early climate action (Monasterolo 2020b). Traditional economic models in force at the IMF and World Bank could be complemented with models rooted in complexity economics and complexity finance (such as Stock-Flow Consistent Models, Agent Based and Network models[2]) that can help navigate the non-linear, deeply uncertain and endogenous

[2] SFC-AB models started to be used by a growing number of central banks and financial regulators (including within the NGFS) and the World Bank (Ranger et al. 2022) for the assessment of climate risks in the economy and finance. Financial network models have been used at central banks since the 2008 financial crisis to capture the role of inter-

nature of climate risks. More broadly, the IMF should incorporate the role of money and credit as discussed earlier in this brief and articulate how the treatment of money supply drives results.

ADOPT A CLIMATE RISK MANAGEMENT APPROACH

Climate risk should be integrated into LICs' fiscal and financial assessment in a manner that is coherent with a risk management approach, which needs to be at the core of scenario analysis and climate stress-tests. The use of satellite data in catastrophic models have proven to be useful to assess the climate risk associatied infrastructure and other damages. Overall, the use of geolocalized, granular asset-level data is crucial to avoid the massive underestimation of financial risk when asset-level data is not used (Bressan et al. 2024).

In contrast, there is a tendency to rely on cost benefit analysis (CBA) approaches to inform climate financial risk assessment and investment decisions. A cost benefit approach has main limitations (Monasterolo 2020) that matter in the context of DSAs. The CBA approach introduces high degrees of subjectivity (e.g. the choice of discount rates), neglects extra monetary dimensions of public climate investing, characterizes climate investments as a cost and neglects the co-benefits created by climate investments, and does not allow for a climate scenario-contingent financial valuation of public debt and relevant climate stress tests.

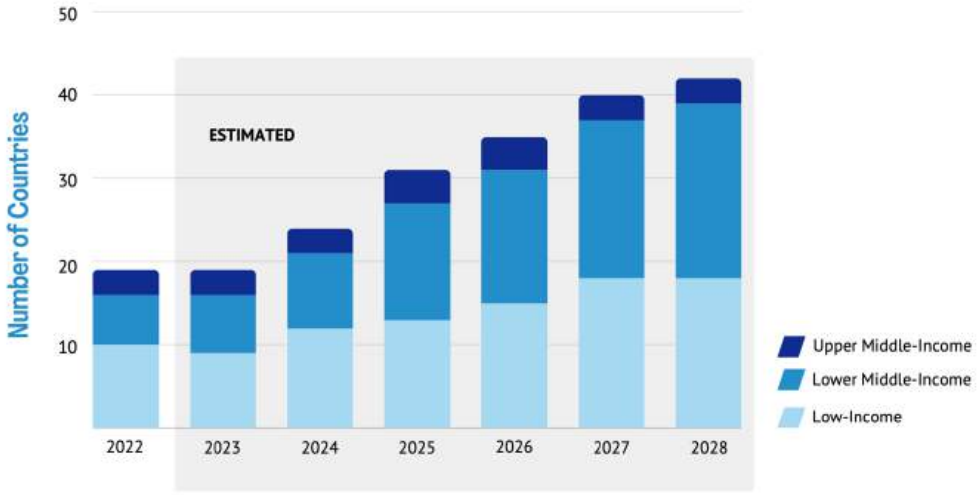
PROVIDING RESOURCE MOBILIZATION PATHWAYS TO ADDRESS CLIMATE RISKS

The damage from climate shocks on growth and development prospects points to the potentially high returns of investments on adaptation and building resilience. The Vulnerable 20 (V20) Group – a group of 68 climate-vulnerable countries – estimates that their GDP could have been 20 percent more between 2000 and 2019 in the absence of climate shocks. Furthermore, a study by Africa Economic Research Consortium researchers shows that climate change induced events that erode agricultural productivity and natural capital are associated with as much as 2 percentage points decline in annual GDP growth rates in Africa (Asafu-Adjaye et al. 2022).

That said, many LICs have very limited capacity to raise fiscal revenues and absorb more debt (Adetutu et al. forthcoming). Analytical work of the Task Force shows that increasing spending to address climate change without new fiscal resources will push public debt trajectories to higher levels (Maldonado and Gallagher 2022; Titelman et al. 2022), exacerbating debt sustainability risks. Zucker-Marques and others (2024) conducted DSA analyses of 66 (of 73) countries eligible for the LIC DSF and showed that 19 of these countries exceeded solvency thresholds. If countries raised the external financing to levels estimated by the G20 Independent Expert Group (2023) in order to invest to meet climate goals and UN 2030 Sustainable Development Goals, the number of countries breaching solvency thresholds more than doubled to 42 countries (see Figure 3).

connectedness in risk propagation in the financial network, and recently applied to climate stress tests (Battiston et al. 2017) including at central banks (Roncoroni et al. 2021).

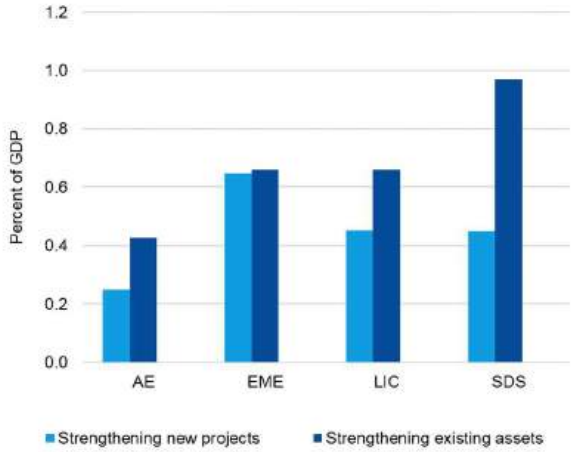
FIGURE 3: NUMBER OF COUNTRIES BREACHING SOLVENCY THRESHOLDS



Source: Zucker-Marques et al. 2024.

Against this background, existing DSAs automatically trigger fiscal consolidation at various thresholds. They tend to consider fiscal multipliers for fiscal adjustment, which have a contractionary effect on growth (Raga 2024). Investments in adaptation could be substantial (see Figure 4), but they could also have high multiplier effects (Raga 2024). DSAs, therefore, should at least generate some scenarios that consider different fiscal responses beyond fiscal consolidation and define financing pathways to undertake these investments – such as through grants, highly concessional sources and domestic resources – that will maintain debt sustainability. This will avoid recommending fiscal consolidation as the sole solution that is consistent with maintaining debt sustainability. As a starting point, however, the IMF should lead the process of aligning the different estimates of investment needs, and subsequently incorporate them into the DSA.

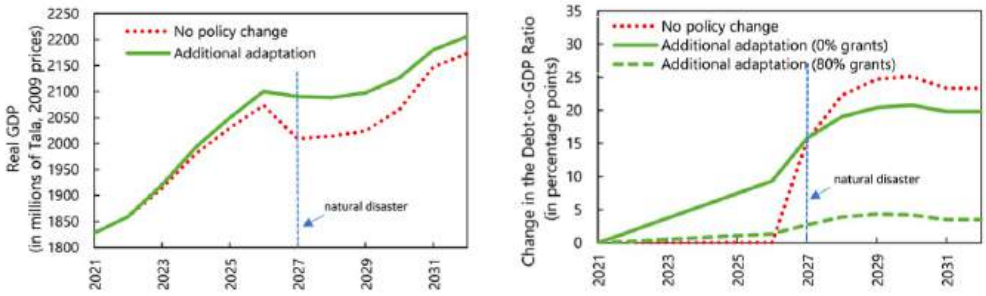
FIGURE 4: ADAPTATION COSTS TO SELECTED CURRENT CLIMATE RISKS IN THE PRIVATE SECTOR (2021–25)



Source: Bellon et al. 2022 based on Hallegatte, Rentschler, and Rozenberg (2019); Hallegatte and others (2019); IMF, Capital Stock 2019 Dataset; IMF, World Economic Outlook database; and staff calculations; Aligishiev, Bellon, Massetti (2022).

The IMF should also identify the mix of grants and concessional resources that will be required so that countries can make the upfront climate investments needed while maintaining debt sustainability. Alternative scenarios that fully reflect the short-term climate investment needs to achieve climate change targets and development goals should be considered. The IMF has already begun doing this exercise in the Climate Macroeconomic Assessment Program (CMAP) for Samoa (Kinoshita et al. 2022). Figure 5, which is reproduced from the Samoa CMAP, illustrates that financing adaptation investments through a financing mix of 80 percent grants enables Samoa to limit the increase in its public debt-to-GDP ratio 3.5 percent in the long run following a natural disaster event. The CMAP further shows how financing ex ante adaptation investment reduces post-disaster financing needs and results in net savings for donors.

FIGURE 5: ADAPTATION FINANCE MIXES AND PUBLIC DEBT IMPLICATIONS



Source: Kinoshita et al. 2022.

Expectations around private finance mobilization need to be tempered with realism. For example, as the IMF Global Financial Stability Report shows, multilateral development banks have mobilized private finance only 1.2 times their own resources (IMF 2022). Private finance mobilization has to be fiscally sound and financially stable. Given the fundamentals of the cost of borrowing against projected medium-term growth rates, public finance will need to continue to play a major role in low-income countries. For example, in 2024, 17 countries had bond spreads above 1,000 basis points, effectively limiting market access, while an estimated 40 countries face interest rates higher than nominal growth rates (Zucker-Marques et al. 2024).

Systematic underinvestment by countries due to lack of financing should also inform the IMF's multilateral surveillance. This should strengthen the IMF's global stance to boost adaptation finance to climate-vulnerable countries. As Task Force research findings show, worrisome levels of debt distress will be reached if concessional financial does not increase for LICs (Adetutu et al. forthcoming). The IMF should highlight the criticality of global cooperation to boost concessional financing, which is particularly crucial for adaptation but which remains the scarcest form of climate financing. The adaptation financing gap has actually widened over time: adaptation needs are now estimated at 10-18 times larger than current flows, and funding pledged for loss and damage is well below estimated needs (Songwe et al. 2023).

Moreover, DSAs are tools used to inform policy makers and creditors of the amount of external debt relief necessary when countries need to undertake debt restructuring. Considering the impact of climate risks, among others, in DSAs should lead to more realistic growth projections but also to better estimates of the required debt relief, which in turn will avoid debt relief that is "too little" to bring the country to a path to growth and debt sustainability. With

policy discussions revolving around how climate action can be unlocked with innovative debt solutions, climate-informed DSAs can provide crucial technical input.

BUILDING CAPACITY AND PARTNERSHIPS TO ENHANCE THE QUALITY AND USE OF DSAS

The LIC DSF is a joint initiative of the IMF and the World Bank. Strengthening their collaboration through a more systematic approach will leverage better the strengths of both institutions. The Independent Evaluation Office (IEO) assessment in 2020 found that their collaboration had been uneven and suggested a more structured approach to better leverage their respective expertise (IMF 2020). The IMF Executive Board members further stressed the importance of a strong partnership with the World Bank in implementing the IMF's Climate Change Strategy (ibid). The IMF can draw on the World Bank's longstanding work on public sector investment programs and knowledge of country-specific drivers of long-term growth and development impact of climate risks, including in its comprehensive CCDR diagnostics.

The IMF should also enhance its own internal human and financial resources to ensure that it can support an ambitious work program on climate change and further integrate climate change considerations into its instruments. The IMF Board should equip the Fund with necessary resources to ensure the staff is well placed to advance the Fund's work on climate change.

Addressing data gaps (especially related to spatial and temporal disaggregation in the context of LICs) to integrate climate risks in DSAs will go beyond traditional areas of the IMF's work. The IMF could engage with its member countries, international organizations, academia and civil society to draw on their knowledge, while building the necessary internal capacity to address data needs, develop reporting tools and boost analytical work. It will also need increase staff resources dedicated to strengthening the climate components of DSAs.

Finally, member countries have an important stake in ensuring the quality and effective use of DSAs. Policymakers can provide valuable country specific information to inform DSAs, which are intended to guide their borrowing decisions to preserve debt sustainability. Building their capacity to contribute to the assessment and use its information to shape their investment and resource mobilization decisions is essential to the success of the DSA.

CONCLUSION

DSAs are powerful tools to inform pathways to development and stability of LICs, which in accordance with the Paris Agreement, should be characterized by investments in climate mitigation and adaptation.

Several LICs are already experiencing the enormous consequences of unraveling climate risks, with negative impacts on their GDP and their fiscal revenues. These in turn increase their debt sustainability challenges and limit their ability to invest in adaptation. DSAs have started to consider the impact of climate change risks, but the methodologies used so far limit the assessment of the scale of climate risks and do not provide adequate guidance on fiscal responses that promote growth enhancing investments.

Here we identify four key areas to strengthen the modeling of climate risks in DSA to better identify and assess their macroeconomic impacts, including on a country's debt vulnerability and probability of default: granularity and relevance of data, use of supervisory climate scenarios, macroeconomic model characteristics, and the adoption of a risk management approach.

Strengthening the methodological approach in line with the state of the art of climate financial risk assessment is crucial to (i) properly assess potential losses, both in the short and mid-long term, (ii) identify and prioritize areas of intervention to fill the climate investment gap and (iii) deploy effective solutions (financial policies and instruments) for climate investing to pursue climate resilient development. In particular, addressing these methodological changes will help the IMF strengthen its assessment of the potential impact of climate risks on growth prospects of countries and their debt vulnerabilities. They will lead to greater realism of growth projections and demonstrate the investment imperatives to build climate resilience and sustainable development.

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