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Macroeconomic policy and climate change: Some developing countries' perspectives

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Macroeconomic Policy and Climate Change: Some Developing Countries' Perspectives

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Abstract

Among the factors that determine countries' macroeconomic performance and outlook, climate change has, since the 1990s, progressively gained significant prominence in national and global public policy discussions, and consequently also in macroeconomic policy analysis. This paper discusses the role of climate change in macroeconomic analysis and argues that a complete macroeconomic analysis of climate change requires that three complementary questions be asked, and adequate answers provided. The first question relates to the macroeconomic impacts of climate change or put differently, the impact of climate change on macroeconomic performance and policy. The second question relates to the impacts of macroeconomic policies on climate change. The third and most important question relates to ways of assessing the macroeconomic performance of climate change policies. While the first and second questions have often been addressed in the still nascent literature on the macroeconomics of climate change, attention to the third question is still at a very early stage of development. ... / ...

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... /... This paper, therefore, focuses on the third question and suggests some issues to consider in addressing it, especially in developing countries' context. In this perspective, the paper suggests that moving from the preparation of NDCs to the preparation of "Just NDCs" is a critical first step towards strengthening the macroeconomic performance of climate change policies. This should be informed by a definition of the macroeconomic stability properties of "just" climate change policies. Mobilizing adequate international financing for climate action will be an important determinant of the macroeconomic performance of climate change policies in developing countries. Developing countries should prioritize strengthening their capacities in these areas.

I. Introduction

Countries' macroeconomic performance and outlook over the short, medium, and long term are influenced, not just by the adequate use of the mainstream macroeconomic policy instruments¹, but also, and more importantly, by several other factors whose effects have profound impacts on all sectors and on the overall performance of the economy. Among these factors, climate change has, since the 1990s, progressively gained prominence in national and global public policy discussions, and consequently also in macroeconomic policy analysis.

Climate change will have profound macroeconomic effects in developing economies. All mainstream macroeconomic variables—from Gross Domestic Product growth, inflation, employment, exchange rates, and inequalities to the structure of the economy, trade, and finance—are and will be impacted in a significant way. Three distinct facts characterize developing economies' relationship with climate change. First, although developing economies' contribution to climate change is negligible they appear to be highly vulnerable to its effects. This means that not only are developing economies being significantly affected by climate change, but they are also being disproportionately affected. Second, most developing economies have to manage the macroeconomic effects of climate change while at the same time managing the macroeconomic effects of other major global economic, financial, and geostrategic shocks to which they are continuously exposed. Thirdly, many developing economies will be facing the macroeconomic effects of climate change from positions of weak macroeconomic management capacities and positions. The macroeconomic implications of climate change in most developing countries will, therefore, be profound and significant. This demonstrates that climate change and climate action should occupy center stage in macroeconomic analysis and policy, especially in developing countries' context.

This paper situates climate change in macroeconomic analysis and argues that a complete macroeconomic analysis of climate change requires that three complementary questions be asked, and adequate answers provided. The first question relates to the macroeconomic impacts of climate change. The second question relates to the impacts of macroeconomic policies on climate change. The third and most important question relates to ways of assessing the macroeconomic performance of climate change policies. This paper further suggests that, while the first and second questions have often been tackled to some extent in the still nascent literature on the macroeconomics of climate change, attention to the third question is still at a very early stage of development². This paper, therefore, focuses on the third question and suggests some issues to consider in addressing it.

¹ The mainstream macroeconomic policy instruments generally include fiscal policy, monetary policy, and exchange rate policy.

² In fact, most of the literature on the macroeconomics of climate change focuses on the first question, i.e., the impact of climate change on countries' macroeconomic performance and policies. See, for example,

Section 2 discusses the causes and effects of climate change. Section 3 focuses on the macroeconomic effects of climate change. Section 4 discusses the assessment of the macroeconomic performance of climate change policies, while Section 5 presents some concluding remarks.

II. The Causes and Effects of Climate Change

Climate change generally refers to the trend of increase in the average temperature on the surface of the earth observed at least since the late 1800s when data on global temperatures became regularly available. Warming has rapidly intensified across the world since the early 2000s. Unlike in Europe and North America, where heat waves have been observed since the 1930s, the rise in temperature is a more recent phenomenon in Africa and Asia. In its Climate Change and Green Growth Strategic Framework 2021-2030, the African Development Bank defines climate change as follows: “A change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically for decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes (IPCC, 2014)”³.

According to the United Nations, the 2011-2020 period was the warmest on record, and each decade has been warmer than the previous one since the 1980s⁴. Nearly all land areas are seeing more hot days and heat waves. Temperatures in the Arctic have warmed at least twice as fast as the global average. Scientists attribute this phenomenon, also known as global warming, mostly to the high concentration in the atmosphere of carbon dioxide (CO₂) and other greenhouse gas, which traps the sun’s heat and leads to an increase in average temperature on the surface of the earth.

The high concentration of CO₂ and other greenhouse gas in the atmosphere results from the use of coal, oil, gas and other fossil fuels in various human economic activities, ranging from power generation to consumption patterns, including manufacturing of goods, deforestation, food production, transportation, or powering buildings and other residential constructions. It is estimated that the use of fossil fuels is the largest contributor to climate change, accounting for about 75 percent of global greenhouse gas emissions and 90 per cent of all carbon dioxide emissions.

Most CO₂ emissions come from a few countries and activities. According to the United Nations Environment Programme, the top seven emitters (China, the EU27, India, Indonesia, Brazil, the

Pisani-Ferry 2021. Although the discussion in that paper appears to focus primarily on developed country contexts, one can safely extend its conclusions to developing economies’ contexts. Other papers discussing the impacts of climate change on macroeconomic performance and policies are referred to below. For a discussion of the effects of macroeconomic policies on the environment see, for example, Ghandi and McMorran 1996. Their paper concludes that (i) macroeconomic stability is a minimum and necessary condition for preserving the environment, (ii) macroeconomic policies can sometimes harm the environment but only indirectly and only when serious market or policy failures exist, and (iii) macroeconomic policies are inefficient instruments for mitigating environmental degradation: appropriate environmental policies are more efficient and effective. We are not aware of previous papers addressing the third question, i.e., assessing the macroeconomic performance of climate change policy.

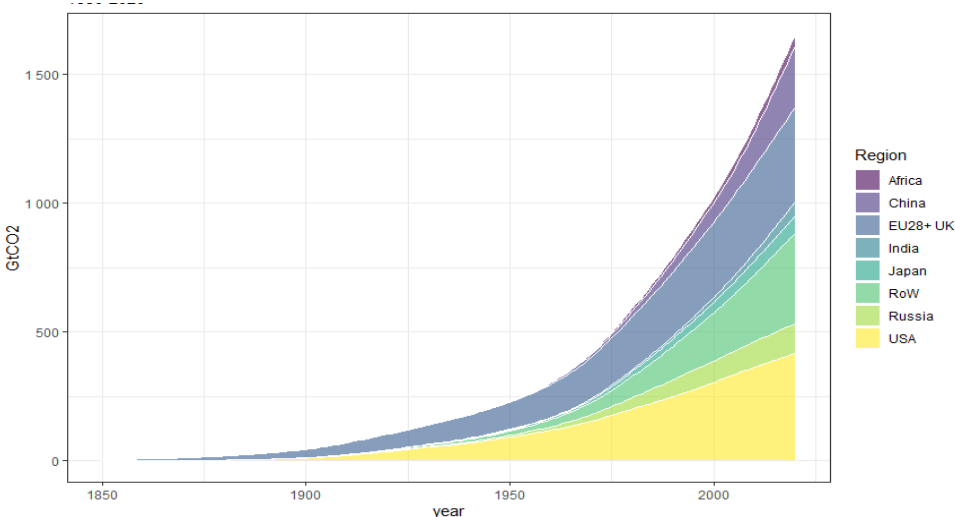
³ Source: African Development Bank (2021) “Climate Change and Green Growth Strategic Framework: Projecting Africa’s Voice Policy”.

⁴ Source: <https://www.un.org/en/climatechange/science/causes-effects-climate-change>.

Russian Federation, and the United States) and international transport accounted for 55 percent of global Greenhouse Gases (GHG) emissions in 2020. Collectively, G20 members (Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States, and the European Union) are responsible for 75 per cent of global GHG emissions⁵. Developed countries have historically been the largest emitters of GHGs and have had a greater impact on climate change than other countries. However, their emissions have been declining in recent years owing to policy interventions, such as the adoption of renewable energy and energy efficiency measures.

Although lower than those of advanced countries, emissions per capita in GHGs emissions in emerging market countries, including India, China, Brazil, and Indonesia, have increased significantly in recent years because of rapid economic growth and industrialization. This has led to the argument that developed countries should bear the brunt of the responsibility for addressing climate change. Other emerging market economies, such as Mexico, South Korea, and Turkey have also experienced rapid growth in their emissions, as they become more industrialized and urbanized. They have not yet reached the developed countries' level of emissions, but their emissions are increasing faster than those of developing countries. Although they have the lowest levels of GHG emissions, small island developing states are the most vulnerable to the impacts of climate change such as sea level rise, ocean acidification, and more frequent and intense natural disasters. Least developed countries, including many African and Asian countries with very low levels of GHG emissions are also among the most vulnerable to the impacts of climate change. They argue that developed countries should take the lead in addressing climate change, as they are the ones who have historically contributed the most to the problem. Figure 1 below shows the cumulative carbon emissions by region, from 1850 to 2020. As is appears, historically, the high emitters of CO₂ are the United States and Russia. Africa records the lowest level of greenhouse gas emissions per capita.

Figure 1: Cumulative Carbon Emissions by Region, 1850-2020



Source: African Development Bank (2022) "AEO 2022".

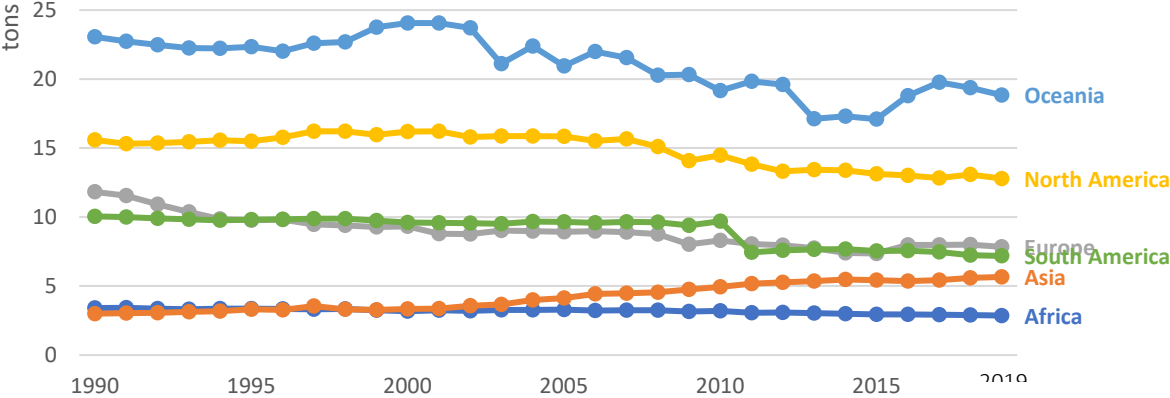
⁵ Source: United Nations Environment Programme. "The Closing Window Climate crisis calls for rapid transformation of societies Emissions Gap Report", 2022, p. XVII. Available at: <https://www.unep.org/resources/emissions-gap-report-2022>.

Africa is the least GHG-emitting region in the world. The African Development Bank estimates that (i) between 1850 and 2020, Africa’s contribution to global emissions remained below 3%, hardly reaching about 4% in 2021; (ii) in 2020, the average American had a carbon footprint of 14 tons CO₂eq (tCO₂eq), and the average African 0.95 tCO₂eq, much below the required global per capita average of 2.0 tCO₂eq needed to achieve the Paris Agreement; (iii) a large proportion of historical and current emissions are from developed and emerging economies—the United States, the 27 European Union countries, the United Kingdom, and China—accounted for about 70% of cumulative carbon emissions (African Development Bank, African Economic Outlook 2022).⁶

Figure 2 below shows the trend in per capita term of greenhouse gas emissions. As is appears, Oceanian countries⁷ account for the highest level of greenhouse gas emissions per capita. They are followed by North America, Europe, and South America. Africa records the lowest level of greenhouse gas emissions per capita.

Figure 2: Per Capita Greenhouse Gas Emissions

Emissions are measures in carbon-dioxide equivalents. Emissions from land use change, which can be positive or negative are taken into account.



Source: CAIT Climate Data Explorer via Climate Watch, <https://ourworldindata.org/co2-and-greenhouse-gas-emissions>, CC BY.

The literature on the impacts of climate change is now converging towards a consensus that higher average temperatures on the surface of the earth are having profound and devastating effects on economies and on life on earth more generally. These impacts include both physical and transition effects. Physical effects refer to the increase in the frequency and intensity of extreme weather events, such as more severe storms and heat waves, increased droughts, floods, and hurricanes. Increased health risks, disruptions in food production value chains, loss of species on land and in the oceans, and more displacement of people and increased poverty are also associated with the physical effects of climate change. Transition effects of climate change refer to the adjustments in economic structures and outcomes resulting from changes in policy, regulatory frameworks, technology, and economic agents’ preferences necessary to adapt to and or mitigate the physical effects of climate change.

Climate change is a global problem. Limiting climate change and its negative impacts is a collective responsibility of all countries working together. This is why the international community, under the auspices of the United Nations, is leading global efforts to limit climate change and strengthen countries’

⁶ African Development Bank (2022) “2022 African Economic Outlook”, p. 4.
⁷ Australia, Papua New Guinea, New Zealand, Fiji, Solomon Island, Micronesia, Vanuatu, Samoa, Kiribati, Tonga, Marshall Island, Palau, Tuvalu and Nauru.

resilience to it. Under the Paris Agreement on climate change, the parties set a target of reaching net zero GHG emissions by 2050 to limit global warming to no more than 1.5°C above pre-industrial levels. This means cutting new emissions to as close to zero as possible, with any remaining emissions small enough to easily be reabsorbed in the atmosphere by forests and oceans, for example.

Global efforts to fight climate change have focused on mitigation and adaptation. Mitigation efforts aim to reduce the sources or enhance the sinks of GHGs. The IPCC definition of mitigation also considers human interventions to reduce the sources of other substances that may contribute directly or indirectly to limiting climate change. The interventions include the reduction of particulate matter emissions that can directly alter the radiation balance (e.g., black carbon) or measures that control emissions of carbon monoxide, nitrogen oxides, volatile organic compounds, and other pollutants that can alter the concentration of tropospheric ozone, which has an indirect effect on the climate (IPCC 2014). Adaptation efforts aim to strengthen the processes of adjustment to actual or expected climate change and its impacts. In human systems, adaptation seeks to moderate, prevent harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its impacts (IPCC 2014).

III. The Macroeconomic Effects of Climate Change

Climate change will impact countries' macroeconomic performance and prospects through both physical and transition effects. Almost all the mainstream macroeconomic policy variables and instruments are affected by climate change and can affect climate change. These include output and inclusive economic growth, monetary policy and inflation, financial stability, fiscal policy, exchange rate policy, labor markets and employment, inequalities, labor productivity, the capital stock, technological progress, pace of structural transformation, aggregate demand (investment, consumption, trade balance), and savings.

Climate change will curtail economic growth through various channels. The destruction of physical assets, including productive physical capital occasioned by extreme weather events—e.g., floods, severe storms, and hurricanes—will generate negative supply shocks, leading to reduced output and slower economic growth. Also, because of rising temperature, an increasing proportion of capital will be represented by adaptation capital to protect existing capital stock from the damages caused by rising temperatures (Batten 2018). This adaptation capital will not be productive capital *per se*. Global warming will, therefore, lead to lower steady state productive capital stock and consequently slower growth when compared to the trend growth without climate change. Climate change will also slow growth through its effects on aggregate demand. The physical impacts will lead to reduction in physical capital and to significant supply side shocks, which will lead to lower productivity of both capital and labor, and reduced output and incomes. The physical impacts will also lead to destruction of consumer wealth. The above factors may lead to lower actual and expected incomes and, therefore, to reduced private consumption, according to the main theoretical frameworks for analyzing private consumption (Keynesian theory, the life cycle, and the permanent income hypothesis). The uncertainties relating to the future course of transition policies and regulations and market preferences may have negative effects on investment, leading to lower trend growth over the short, medium, and long term.

The African Development Bank estimates that climate change will have severe economic impacts in Africa despite the continent's low contribution to global warming. Thus, across East and West Africa, climate change in the high-warming scenario is estimated to reduce GDP per capita growth by up to 15 per cent below the baseline GDP per capita growth scenario by 2050. North and Southern Africa would also be severely impacted, with around a 10 percent decrease in GDP per capita growth by 2050. Central Africa would face a potential decrease in GDP per capita growth of around 5 percent. Moreover, climate change adaptation alone could cost the continent at least USD 50 billion annually by 2050 (African Development Bank 2022, p. 2).

Contrary to earlier notions, that climate change would mostly impacts developing countries, it also impacts developed countries. Colacito *et al.* (2018) report the following findings for the United States: (i) Rising temperatures could reduce overall growth of U.S economic output by as much as one-third by 2100. (ii) On average, each 1° F increase in the mean summer temperature reduces the annual gross state product rate by 0.154 percentage points. (iii) Higher summer temperatures have a negative impact on many sectors of the U.S. economy, not just on the agricultural sector, as previously thought. In a sample of 124 countries covering the 1961-2010 period and using quantile regressions, Kiley (2021) found that climate change increases the likelihood and severity of economic contractions (measured by the percent change in real GDP per capita), with significant impacts on economic and financial stability and welfare.

Climate change may also affect the design and conduct of monetary policy. In the design and conduct of monetary policy, central banks give serious consideration to the supply side shocks, and demand side effects of climate change discussed above. In fact, the above factors may have important implications for developments in prices and inflation, which need to be considered in the design and conduct of monetary policy. Using a Keynesian DSGE model calibrated to data for the “more developed regions”—a country classification used in the UN populations projections, which include 27 EU countries, four EU candidate countries, UK, Canada, US, New Zealand and Australia—Engin *et al.* (2022) found that climate change disaster shocks increase real interest rates and inflation in these countries, which may also have negative consequences for developing countries, given the influence of the sampled countries on global macroeconomic conditions. Climate change may also undermine monetary policy through its effects on the stability of the financial system, a key factor in the effectiveness of the monetary policy transmission channel, as the physical and the transition risks of climate change may have implications for the value of financial assets and associated risks. Monetary policy authorities, therefore, need to strengthen their understanding of climate change’s potential impact on the design and implementation of monetary policy. This will necessitate efforts to assess and better understand the impacts of climate change on the monetary transmission channels, to gather data on the impacts of climate change, and to develop better climate change forecast tools.

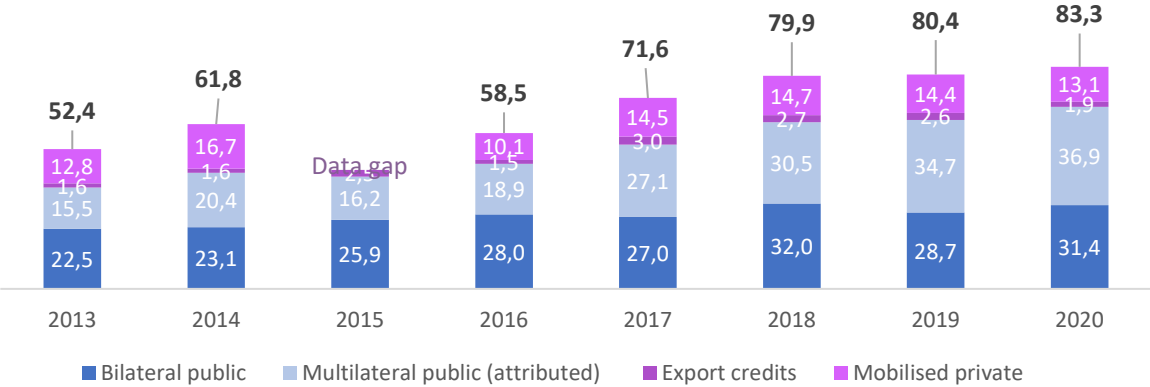
On fiscal policy, climate change adaptation measures—to protect people, homes, businesses, livelihoods, infrastructure, and natural ecosystems from current impacts and those likely in the future and mitigation measures—have implications for both the expenditures side and revenues side of fiscal policy. Fiscal policy authorities need to assess and understand these effects on fiscal policy design and implementation. In developing country contexts, a major consideration on the revenue side will revolve around the possibilities of tapping into the climate finance promised by developed countries, as well as other available external climate finance instruments. Indeed, for fiscal policy authorities of developing countries to achieve fiscal sustainability while implementing their Nationally Determined Contributions (NDCs), it will be important that developed countries adequately and effectively deliver on their promised climate finance commitments. Indeed, in most developing countries, external financing plays a key role in fiscal policy. In a recent paper on fiscal challenges in Sub-Saharan Africa, Comelli *et al.* (2023) note that these countries are generally characterized by high and growing development financing needs and limited domestic resources. They report estimates from the International Monetary Fund indicating that, in 2022, the median government revenue (excluding grants) represented 17 percent of GDP in the region compared to 26 percent of GDP in other Emerging Markets and Developing Economies and 40 percent of GDP in developed countries. In such contexts and with domestic financial markets still under development, the role of external financing in fiscal policy stability and macroeconomic stability becomes more important. In these circumstances, a key task for fiscal policy authorities in developing countries will, therefore, be to effectively monitor these external climate finance commitments with a view to ensuring their effective delivery. Some of these commitments are elaborated below.

At COP15, in Copenhagen, in 2009, developed countries made a commitment to mobilize USD 100 billion per year to support meaningful climate change mitigation actions in developing countries. At COP21, in Paris, in 2015, this commitment was reiterated and extended to 2025. On the issue of financing for loss and damage caused by climate change some progress was made at COP27, in Sharm el-Sheikh, in 2022, with “*the consideration, for the first time, of matters relating to funding arrangements responding to loss*

and damage associated with the adverse effects of climate change, including a focus on addressing loss and damage..... the adoption of decisions -/CP.2714 and -/CMA.4,15 establishing the institutional arrangements of the Santiago network for averting, minimizing and addressing loss and damage associated with the adverse effects of climate change to enable its full operationalization, including supporting its mandated role in catalyzing technical assistance for the implementation of the relevant approaches at the local, national and regional level in developing countries that are particularly vulnerable to the adverse effects of climate change, and affirms its determination to select the host of the secretariat of the Santiago Network by 2023 through a selection process conducted in an open, transparent, fair and neutral manner in accordance with the process outlined in paragraphs 17–18 of decisions -/CMA.416 and - /CP.27;17’ (Decision -/CP.27, Sharm el-Sheikh Implementation Plan, 2022).

The Green Climate Fund (GCF), the largest international fund dedicated to supporting climate action in developing countries, has approved over USD 3.5 billion in funding for projects and programs in African countries as of 2021. The African Development Bank has also launched several initiatives to support climate adaptation and mitigation efforts in Africa. Notable among the Bank’s initiatives is the Africa Climate Change Fund, which has mobilized over USD 1.5 billion since its launch in 2014. Other available funding sources, include the Climate Investment Funds, the Global Environment Facility, and various bilateral and multilateral climate finance mechanisms. However, the total funding available for climate change adaptation and mitigation in Africa is not sufficient to fully address the scale of the challenge facing the continent. Ongoing efforts are needed to mobilize additional funding and support for climate action in Africa. As illustrated in Figure 3 below, a recent OECD report shows that climate finance developed countries provide to developing countries increased from USD 52 billion in 2013 to USD 83 billion in 2020, but still fell short of the USD 100 billion per year target (OECD 2022).

Figure 3: Climate finance provided and mobilised in 2013-2020 (USD billion)

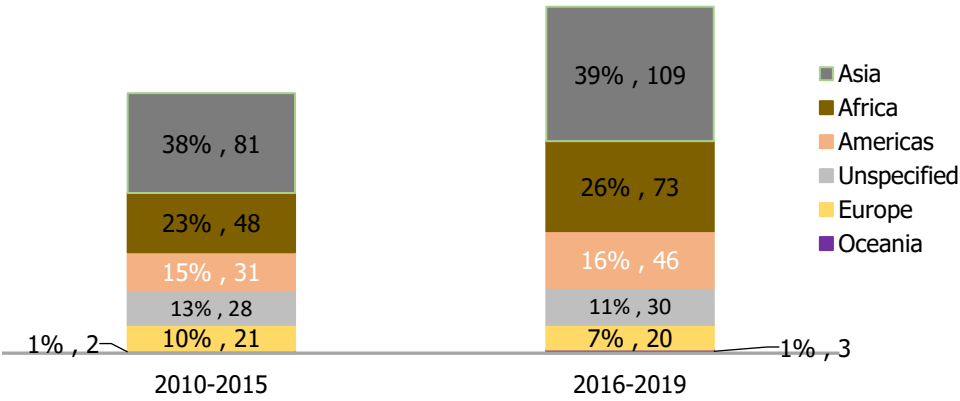


Source: OECD (2022) “Aggregate Trends of Climate Finance Provided and Mobilized by Developed Countries in 2013-2020”.

Note: The sum of components may not add up to totals due to rounding. The gap in time series in 2015 for mobilised private finance results from the implementation of enhanced measurement methods. As a result, grand totals in 2016-2020 and in 2013-2014 are not directly comparable.

Figure 4 below shows world regions’ shares in climate finance. Africa’s share of global climate finance has only marginally increased since 2010, even though the continent contributes little to global emissions and remains the most vulnerable to climate change. The Americas registered the fastest increase in climate finance.

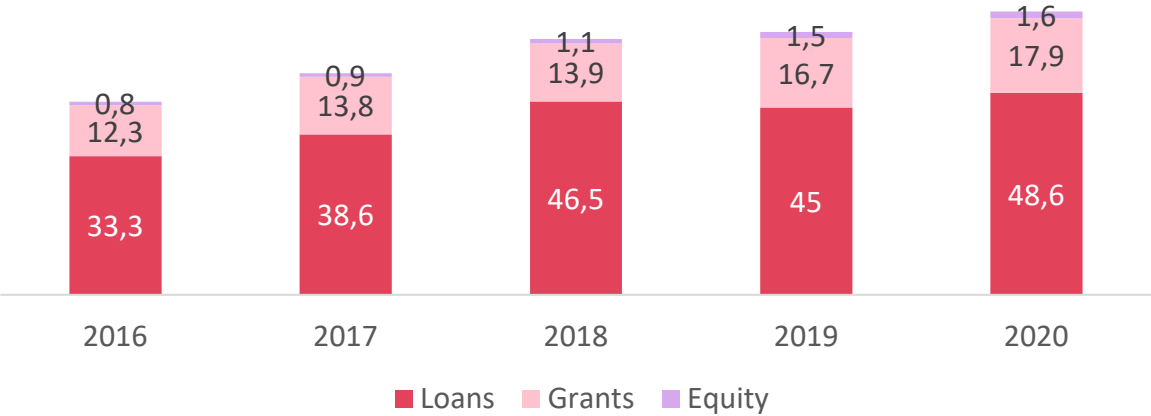
Figure 4: Shares in Global Climate Finance (Total, in USD billion; share, in percentage)



Source: African Development Bank (2022) "AEO 2022".

In addition to the aggregate figures of climate finance, which fall short of commitments, data on the composition of these financing also point to three rebalancing, which need to happen. As shown in Figure 5, significant portion of the funding provided is still in the form of loans, which could place a burden on recipient countries, rather than grants or other forms of concessional finance. Emphasis should, therefore, be placed on concessional finance instead to safeguard debt sustainability, especially given the challenging fiscal situation most of these countries are already facing.

Figure 5: Instrument split of public climate finance in 2016-2020 (USD billion)

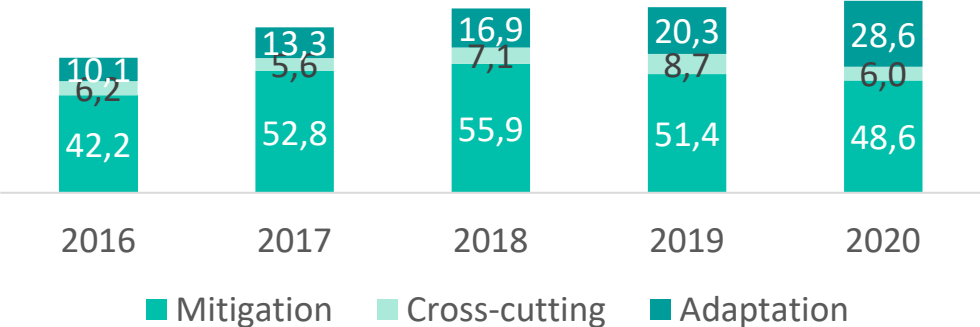


Source: OECD. "Aggregate Trends of Climate Finance Provided and Mobilized by Developed Countries in 2013-2020", 2022.

Note: The sum of instruments may not add up to totals due to rounding.

There is also the need to further improve the balance of climate finance provided between adaptation and mitigation. As shown in Figure 6 below, although this rebalancing appears to have been happening over the period 2016-2020 as adaptation finance represented USD 28.6 billion (34.4 percent of climate finance) in 2020, up from USD 10.1 billion (17.3 percent) in 2016, and mitigation finance represented USD 48.6 billion (58.4 percent of climate finance) in 2020, down from USD 42.2 billion (72.1 percent in 2016), there is to further improve this balance, especially in developing countries' contexts.

Figure 6: Thematic split of climate finance provided and mobilised (USD billion)

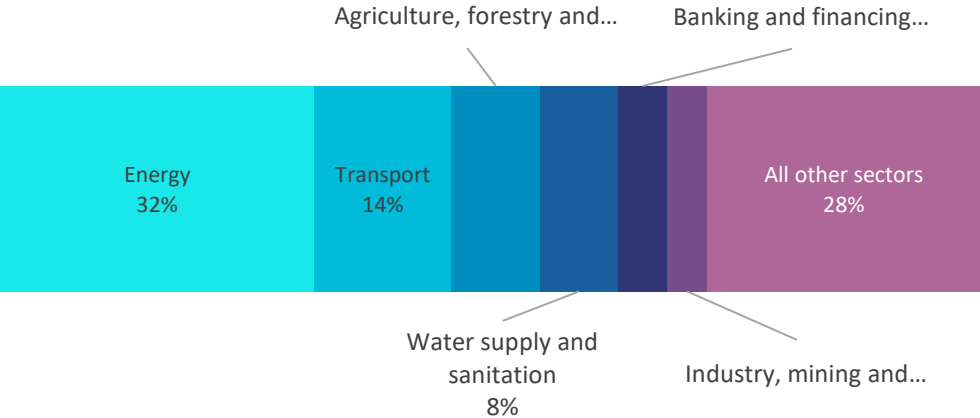


Source: OECD (2022) "Aggregate Trends of Climate Finance Provided and Mobilized by Developed Countries in 2013-2020".

Note: The sum of instruments may not add up to totals due to rounding.

The international community also needs to pursue efforts to further improve the sectoral balance of climate finance provided to developing countries with more climate finance channeled to the agriculture, forestry, fishing, industrial, water supply and sanitation sectors given the key roles of these sectors in supporting the inclusive development and job creation objectives of these countries. As illustrated in Figure 7 below, these key sectors currently represent only a negligible proportion of climate finance mobilised and provided by developed countries.

Figure 7: Sectoral split of climate finance provided and mobilized (in percent)



Source: OECD (2022) "Aggregate Trends of Climate Finance Provided and Mobilized by Developed Countries in 2013-2020".

Note: The sum of instruments may not add up to totals due to rounding.

Beyond the amounts of resources mobilized by the various climate funds, it would, however, appear that the real challenges developing countries face when it comes to climate finance are related to the high fragmentation and low efficiency and impacts of these funds. In a recent paper, Le Houérou (2023) noted (i) the huge number of climate funds in existence (at least 94 might have been created over the last 30 years, and 81 were in existence by the end of 2022), (ii) challenges in assessing the financial management and impact of these funds and called for major reforms of these funds. These challenges underscore the need for developing countries to prioritize the strengthening of national capacities in mobilizing and managing climate resources.

In addition to climate funds, a potential source of important resources for the financing of climate actions in developing countries is the effective use of carbon credits. An African Development Bank's analysis of the carbon budgets and carbon debts shows that Africa has a total carbon credit of USD 4.58–USD 4.8 trillion, averaging USD 4.64 trillion, a credit that considers historical, current, and future shares of carbon emissions (African Development Bank 2022, p. 121). The African continent and other developing regions, with such large amounts of carbon credits, should be compensated for contributing so immensely to humanity's climate change goals by historically keeping their emissions low. This shows that developing countries can potentially mobilize significant amounts of climate resources from their available carbon credits provided a sound global dialogue on carbon credits and carbon debts is successfully carried out. Other considerations on the revenue side of fiscal policy will include exploring the feasibility of a carbon tax to generate public revenues, developing effective carbon markets, assessing, and managing the revenue-impacts of the negative effects of climate change on growth. But to achieve this, these countries will need to strengthen efforts aimed at ensuring adequate functioning of carbon markets so that the carbon price reflects the true value of the service developing countries provide to humanity by keeping their emissions low. Ideally, the price of carbon should reflect the marginal cost of producing equivalent clean energy developing countries need to power their industrialization and development process.

On the expenditure side of fiscal policy, climate change is also likely to exercise significant upward pressures on public spending. These additional climate change-induced spending pressures will generally result from increased public spending on adaptation of public infrastructures to the physical effects of climate change or to repair public assets damaged by climate change-related events, public spending on social safety nets support to victims of extreme weather events, higher insurance premiums on public assets, spending on subsidies and public investments to support mitigation and adaptation measures, and public spending on climate change-caused contingent public losses.

As a result of the above-mentioned revenue and expenditure effects, climate change is likely to significantly impact the public debt trajectory in some developing countries. For example, in a recent report, the International Monetary Fund finds that, in Madagascar, a country exposed to frequent and destructive extreme weather events caused by climate change, "public debt would become unsustainable and exceed 85 percent of GDP by 2040 "under a climate-adjusted macroeconomic scenario that includes all humanitarian and reconstruction needs after a disaster and assuming the government fully covers these needs" (International Monetary Fund 2022).

Trade and trade policy are among the other major macroeconomic variables susceptible to significant climate change impacts. The demand and supply side shocks resulting from the physical and transition effects of climate change discussed above may impact countries' factors endowment, and comparative advantage, and its evolution over time. In these perspectives, climate change may affect some major domestic tradable sectors, or some external demand addressed to the home country or critical growth-supporting imports. These effects will certainly impact countries' trade performance, including engendering unfavorable developments in the terms of trade. A recent World Trade Organization report suggests that agriculture, tourism, and some manufacturing sectors may be particularly vulnerable to

climate change.⁸ These developments will also most likely have implications for exchange rates developments and policy, which would need to be carefully assessed and considered.

The objective of country macroeconomic analysis is to conduct macroeconomic surveillance to identify measures needed to achieve the country's macroeconomic objectives, which include strong and inclusive economic growth with job creation, and reduction of poverty and inequalities. In this perspective, efforts to mainstream climate change in country macroeconomic policy analysis should be based on the country's Nationally Determined Contributions (NDC). NDCs contain countries' action plan and targets for adaptation to climate change impacts and reduction of greenhouse gas emissions to mitigate climate change. Under the Paris agreement on climate change, countries committed to preparing NDCs. NDCs are updated every five years.

IV. The Macroeconomic Performance of Country Climate Change Policies

A complete analysis of the interlinkages between macroeconomic analysis and climate change requires that three complementary questions be asked, and adequate answers be provided. The first question relates to the macroeconomic impacts of climate change. This question has often been asked and although analytical tools are still being developed, much progress has been made towards answering this question. In the above discussion, we have reported some of the findings of this rich and growing line of research. The second question relates to the impacts of macroeconomic policies on climate change. This question has also been often asked and answered. We have also reported above some of the findings of this work, which generally tend towards the higher impact that macroeconomic policies of developed countries have had on climate change, compared to developing countries. These impacts also vary by country and regions both within the developed country group and the developing and emerging countries group. A third and important question relates to the macroeconomic performance of climate change policies. Considering the now well-established and significant impacts of climate change on macroeconomic outcomes, there is need to mainstream climate change policies as a macroeconomic policy tool, which macroeconomic policymakers could also use to achieve macroeconomic policy objectives, in about the same way they use the other traditional macroeconomic policy instruments to pursue macroeconomic policy objectives. In this perspective, a key question to ask is what macroeconomic stability properties would be expected of climate change policies? In other words, what properties would be expected of climate change policies contributing to macroeconomic stability, inclusive economic growth and sustainable development, reduced poverty and inequality, and jobs creation while meeting climate change commitments defined in their NDCs? The concept of macroeconomic performance of climate change policies refers to this question.

In developing countries' contexts, the above question acquires significant importance. In those contexts, key amongst the macroeconomic stability properties of climate change policies are climate change commitments, which embody the notion of "just commitments". COP27 in Sharm el-Sheikh emphasized that *"just and equitable transition encompasses pathways that include energy, socioeconomic, workforce and other dimensions, all of which must be based on nationally defined development priorities and include social protection so as to mitigate potential impacts associated with the transition and highlights the important role of the instruments related to social solidarity and protection in mitigating the impacts of applied measures."*⁹ It also affirmed *"that sustainable and just solutions to the climate crisis must be founded on meaningful and effective social dialogue and participation of all stakeholders."*¹⁰ The recognition of the need for just solutions to climate crisis provides the policy space developing countries need to strengthen synergies between their macroeconomic objectives with their climate change commitments actions. The *"justness"* of the climate change commitments specified in the NDCs is therefore a critical first step in the assessment of the macroeconomic performance of climate change policies. In this context, countries should move

⁸ World Trade Organization (2022) "World Trade Report 2022 Climate Change and International Trade".

⁹ Source: UNFCCC (2022) "Decision -/CP.27 Sharm el-Sheikh Implementation Plan", p. 6.

¹⁰ Source: UNFCCC 2022, *op.cit.*

from preparing NDCs to preparing “Just NDCs”. Considering the weak state of capacities in most developing countries, substantial strengthening of capacities for the preparation of “Just NDCs” would be top priority. From a macroeconomic perspective, strong climate change policies would also require that the authorities resolutely strengthen national analytical capabilities in macroeconomic analysis of climate change issues, including the analysis of the fiscal implications of climate change, the design and implementation of climate change-related fiscal rules that factor in the country’s unique fiscal and macroeconomic situation and prospects, the effective use of available fiscal policy instruments such as taxes, subsidies and transfers, to achieve just climate commitments. Strong macroeconomic climate change policies would also involve significant strengthening of national analytical capabilities in the design and implementation of climate change-resilient monetary policy and financial sector stability policies. Towards these ends, significant efforts will need to be devoted to the collection of data and statistics on the physical and transition risks of climate change.

Considering the significant trade implications of climate change discussed above, trade policy appears to be another key tool to consider in discussions of the macroeconomic performance of climate change policies. In line with countries’ just commitments as articulated in the NDC, trade policy should aim at supporting “just” climate change adaptation and mitigation objectives. This will generally involve facilitating access and reducing the trade costs of goods and services for adaptation, clean technology for mitigation objectives, and ensuring effective participation in climate change-related global trade negotiations, including on environmental goods and carbon pricing (WTO 2022).¹¹ It is particularly important to ensure that trade policy measures implemented to adapt to climate change-caused events safeguards countries’ long term development policy priorities while supporting short-term adaptation objectives. In this context, Casella H. and De Melo J. (2022) noted the spillovers effects of some measures implemented during the 2015-2016 drought episode in Southern Africa.

Throughout this paper, we have suggested the concept of “Just” NDC and made it a cornerstone of our argument. Given the importance we have attached to this concept in this paper even a brief discussion of its meaning here would be in order. What would a “Just” NDC mean exactly? “Just” NDC would refer to NDC, that embodies a complete, advanced, and shared understanding by all parties of the need for effective, concrete and enhanced prioritization of poverty reduction, sustainable growth and inclusive development, jobs creation, industrialization, food security, macroeconomic stability, and the lead role of developed countries in taking action to tackle climate change (emissions reduction and adaption) and providing the necessary resources to support climate action in developing countries, while tackling climate change. “Just” NDC would be reflections of these key notions, always fervently proclaimed in global climate policy discussions and commitments but also always fervently insufficiently put into practice¹².

¹¹ For a more detailed discussion of climate change and trade and trade policy, see World Trade Organization (2022) “World Trade Report 2022”.

¹² The recent Africa Climate Summit held in Nairobi, Kenya, from 4 to 6 September 2023, which brought together African Heads of State and Government, other global leaders, intergovernmental organizations, regional economic communities, United Nations Agencies, private sector, civil society organizations, indigenous people, local communities, farmer organizations, children, youth, women, and academia, reaffirmed one of the key principles of the historic Paris Agreement on climate change, which is equity, and common but differentiated responsibilities and respective capabilities of developed and developing countries on climate change action. The Summit also “called on the global community to act with urgency in reducing emissions, fulfilling its obligations, keeping past promises, and supporting the continent in addressing climate change, specifically to: Honor the commitment to provide \$100 billion in annual climate finance, as promised 14 years ago at the Copenhagen conference”. See African Union and Government of Kenya “African Leaders Nairobi Declaration on Climate Change and Call to Action”. In June 2023, the Paris Pact for People and Planet (4P), one of the key outcomes of the Paris Summit for a New Global Financing Pact, reaffirmed that “no country should have to choose between fighting poverty and fighting for the planet... facing different needs countries may need to pursue different transition paths while coming together to meet the goals of the Paris Agreement... We need a financial stimulus with more resources to support vulnerable economies lifting their population out of poverty while protecting the planet”. See “The

As indicated in section II above, developing countries have been arguing that developed countries should bear the brunt of the responsibility for tackling climate change because developing countries have historically been responsible for a greater share of emissions responsible for climate change. The box 1 below summarizes the key issues to consider in assessing the macroeconomic performance of climate change policies.

Box 1
Key Issues to Consider in Assessing the Macroeconomic Performance of Country Climate Change Policies

In view of the preceding, an assessment of the macroeconomic performance of climate change policies may include the following components.

- a. A discussion of plans to strengthen analytical capacity in the preparation of “Just Nationally Determined Contributions.”
- b. A discussion of the state of progress in the preparation of “Just Nationally Determined Contributions,” which sets “just”, clear, ambitious, but realistic climate change mitigation and adaptation targets. “Just NDCs” consider the country’s macroeconomic objectives as the starting point.
- c. A discussion of plans to strengthen analytical capacity in climate change analysis and incorporation in macroeconomic policy design and implementation in key government entities responsible for macroeconomic policy.
- d. A discussion of the fiscal implications of climate change, including progress on strengthening capacity to mobilize and manage climate finance resources, and on considering the design and implementation of climate change-related fiscal rules.
- e. A discussion of progress in considering climate change in the design and implementation of monetary policy.
- f. A discussion of progress in considering climate change in the design and implementation of trade policy.
- g. A discussion of plans to strengthen the collection of macroeconomic data on climate change impacts.
- h. A discussion of progress in considering climate change in the design and implementation of other policy tools with potential macroeconomic implications.

V. Conclusion

Over centuries, the world’s economic evolution has been shaped by major developments, notably technological progress, which started with the industrial revolution in the 18th century, globalization, digitalization and the fourth industrial revolution, demographic changes, the rise of China and indeed the East Asia and, more recently, the great fragmentation unleashed by the great confrontation between Russia and the West.¹³ Since the 1990s, climate change has emerged as another mega trend, which is going to shape the future of the world economy over the coming centuries. Policymakers should endeavor to consider its implications for the macroeconomy. Country macroeconomic analysis should aid policymakers in this endeavor by also mainstreaming climate change in its toolkit.

Paris Pact for People and Planet (4P)” available at: <https://nouveaupactefinancier.org/pdf/the-paris-pact-for-people-and-the-planet.pdf>.

¹³ Although the great confrontation between Russia and the West is directly visible to most observers, it would not be an exaggeration to claim that it is only the tip of the iceberg of more profound geostrategic turbulences involving the West and major emerging economies, which will have far reaching consequences for the world economy.

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