

**PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING THE
GROWING DEBT CRISIS PROJECT**

**CLIMATE CHANGE,
FISCAL RISKS AND PUBLIC
DEBT MANAGEMENT
IN LATIN AMERICA**

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SUPPORT

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CLIMATE CHANGE, FISCAL RISKS AND PUBLIC DEBT MANAGEMENT IN LATIN AMERICA

Working Paper of the Project “*Promoting a pandemic recovery: evidence to support managing the growing debt crisis*” (IDRC - Red Sur N° 109742-001)

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Policy Brief No 1/2022	G20 Policy Brief Indonesia 2022. Policy Proposals for External Debt Management and Sustainability in Developing and Low-Income Countries TF7 - International Finance and Economic Recovery	Fernando Lorenzo (Centro de Investigaciones Económicas), Luis Miguel Galindo (Universidad Nacional Autónoma de México), Ramiro Albrieu (CIPPEC), Dionisio Borda (Centro de Análisis y Difusión de la Economía Paraguaya), Paul Lakuma (Economic Policy Research Centre), Mma Amara Ekeruche, Alemayehu Geda (Addis Ababa University), and Arjan de Haan (IDRC)
Policy Brief No 2/2023	LAC Policy Brief “Results and Policy Implications in Latin America”	Miguel Galindo (UNAM), Fernando Lorenzo (CINVE/Red Sur) and Ramiro Albrieu (Red Sur)
Policy Brief No 3/2023	Construyendo un futuro sostenible en el Sur Global	Ramiro Albrieu (Red Sur)
Policy Brief No 4/2023	Policy Brief I - Ethiopia: Profile of Ethiopian Debt and its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Policy Brief No 5/2023	Policy Brief II - Ethiopia: Fundamental and Proximate Drivers of Public Debt in Ethiopia (1980-2023)	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Policy Brief No 6/2023	Policy Brief III - Ethiopia: A Two-Edged Sword: The Impact of Public Debt on Economic Growth—The Case of Ethiopia	Addis Yimer and Alemayehu Geda (Addis Ababa University/AAU)
Working Paper No 1/2023	Background Document ‘Fiscal and Financial Challenges of Climate Transition in Latin America’	Luis Miguel Galindo (UNAM) and Fernando Lorenzo (CINVE/Red Sur)
Working Paper No 2/2023	Climate Change, Fiscal Risks and Public Debt Management in Latin America	Luis Miguel Galindo (UNAM) and Fernando Lorenzo (CINVE/Red Sur)
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Working Paper No 4/2023	Investment Incentives and Sustainable Productive Transformation in Latin America	Andrés López (IIEP-UBA-CONICET/Red Sur) and Alvaro Ons (CINVE/Red Sur)
Working Paper No 5/2023	Estudio País: Construyendo un Futuro Sostenible en Bolivia (in Spanish)	Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda (Fundación ARU)

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Working Paper No 11/2023	Sustainable, Inclusive and Environmentally Responsive Debt in Uganda: Implication of COVID 19	Economic Policy Research Centre (EPRC)
Working Paper No 12/2023	Profile of Ethiopian Debt and Its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Working Paper No 13/2023	Fundamental and Proximate Drivers of Public Debt in Ethiopia	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
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EXECUTIVE SUMMARY

The objective of this paper is to define a framework for the analysis of fiscal policies and public debt management strategies for Latin American countries facing climate change. The focus of the work lies on the construction of an analytical framework to evaluate the situation of public finances in the region's post-pandemic economies and on identifying the possibilities and risks of new fiscal and financial instruments to face the challenges posed by the response to climate change in the medium and long term.

In recent decades, Latin America - with its differences by country - has shown economic and social progress supported by relatively volatile economic growth subject to various external and internal shocks. However, these advances are insufficient to solve various structural problems such as chronic poverty and high-income concentration. Additionally, multiple negative externalities, such as atmospheric pollution and greenhouse gas emissions, persist and are intensifying, thus eroding the foundations of the current economic dynamism.

In this context, public finances and external debt management face severe challenges in Latin America. Generally speaking, public finances display a structural weakness associated with the limited availability of fiscal space. This weakness is expressed by persistent imbalances in public accounts. Thus, various external or internal shocks result in volatile public deficits that are passed on to public debt. This situation leads to various macroeconomic imbalances that have a negative impact on economic dynamism.

This deterioration of public finances has intensified as a result of the following:

- Addressing the effects of the COVID-19 pandemic, which reduced tax revenues and generated strong pressures on spending levels to address the health emergency and to support economic recovery.
- High international interest rates that are increasingly reflected in public debt service payments.
- The volatility of the prices of primary products and raw materials that are exported by the region which have served as a particular and significant tax base.
- Climate change that is causing significant economic losses in tax revenues, with its consequent demand for additional public spending to address these climate shocks and to build a carbon-neutral economy between 2050 and 2070, which implies recognizing the presence of new spending patterns and tax revenues as well as the presence of important stranded assets that manifest themselves in significant losses in tax revenues and economic dynamism.
- Natural disasters that generate reductions in tax revenues and additional public spending, which generally result in an increase in the public deficit.

This situation poses a new challenge for Latin America's fiscal policy and public debt management. Public finances in the region's countries currently show significant fragility. They will have to face the challenge of contributing to greater post-pandemic economic dynamism while simultaneously addressing the challenges posed by the high vulnerability derived from the adverse effects of climate change and the challenges posed by the just climate transition to a carbon-neutral economy between 2050 and 2070.

Meeting this challenge requires a new fiscal and public debt management strategy to increase fiscal revenues, reorient public spending, relax the restrictions resulting from the available fiscal space, contribute to the preservation of macroeconomic balances and generate a new

profitability matrix that is consistent with the objectives of the climate transition and the construction of a climate-resilient economy, as well as the transition to sustainable development. This implies addressing the structural problems manifest in unequal income distribution, high and persistent poverty levels, and multiple gender inequalities.

Climate change has significant, widespread and more intense negative effects on economic activities in poorer and warmer countries or regions. It severely impacts social conditions and the environment. At the same time, the 2015 Paris Agreement on climate change established the goal of temperature increase between 1.5° C and 2° C, which requires reaching a carbon-neutral economy between 2050 and 2070. All this means that climate change represents an obstacle to development (Dell et al., 2014).

Implementing a just transition to a carbon-neutral and climate-resilient economy implies deploying a new development strategy in which fiscal policy and public debt management must prioritize the urgency of mobilizing resources to carry out the required structural transformations in the production and consumption patterns that prevail in the region's countries. Available estimates of the fiscal effort needed by 2030 to act effectively on the emerging matrix of climate change risks require maintaining an infrastructure investment of between 2% and 8% of GDP and between 2% and 5% of GDP to address social challenges. Even greater efforts will probably be required to achieve environmentally sustainable development in the long term.

The capacities, possibilities and limitations of fiscal and public debt policy in the context of climate change can be analyzed based on the construction of scenarios on the physical risks of climate change and climate transition for the sustainability of fiscal and public debt policy (NGFS, 2021). Considering its relevance for achieving sustainable development, a gender scenario was also included.

These scenarios illustrate the relevance of: (i) implementing a new comprehensive fiscal strategy, which contributes to greater economic dynamism and, at the same time, generates incentives to carry out structural transformations in the forms of production and consumption patterns to achieve a carbon neutral and climate resilient economy; (ii) recognizing the need to implement specific fiscal programs to address physical risks and the risks of a just climate transition as a green or environmental fiscal strategy. The design of public policy actions should incorporate their repercussions on output and income distribution; (iii) taking into account the potential consequences of the accelerated loss of tax revenues from activities with high carbon content (stranded assets); (iv) implementing public debt management that integrates the opportunities offered by climate and sustainable financing to improve the conditions for accessing new sources of revenue in terms of interest rates, periods and currency denomination, as well as incorporating explicit commitments and specific actions to achieve climate goals and meet the sustainable development goals of the 2030 Agenda.

The path to be followed by the region's countries involves not only changing fiscal and budgetary priorities but also requires moving towards a new institutional framework that establishes coherence among the policies applied and develops coordination and cooperation mechanisms, both among government agencies and in the relationship between the public sector and private actors. The relevance that environmental and social sustainability dimensions are acquiring in the financial management of public indebtedness is leading to greater interest on the part of the Ministries of Finance (who will have to transform their fiscal and debt management tools and take on a more leading role in the development of transparent systems for programming, measuring, reporting and verification of the National Climate Change Policy), and of the Central Banks (who will have to incorporate environmental dimensions into their regulatory standards for local financial markets).

The benefits that could be derived from the advance of sustainable finances are related to the permanent nature that the new conditions for access to sovereign financing seem to be acquiring. The current reality regarding fiscal policy and public debt management seems to indicate that environmental and social sustainability should be considered simultaneously with the intertemporal sustainability of public finances. There are intangible reputational benefits countries that could achieve by adhering to international climate change efforts that should be added to the obvious financial advantages that would derive from the new financial practices. However, consideration should also be given to the importance of meeting the objectives that are set out in sustainable financing. It should, however, not be overlooked that public commitment to the sustainable development agenda is a necessary condition for the climate change mitigation and adaptation agenda and for progress towards the achievement of the SDGs. This agenda should enter more forcefully into the decision-making processes of the private sector, which is called upon to proceed with very important transformations in its investment, production and consumption behaviors.

I. INTRODUCTION

The objective of this study is to define a framework that can serve as a reference for the analysis of fiscal policies and public debt management strategies in Latin American countries in the face of climate change. Conceptually, the proposal is based on a broad definition of the concept of fiscal sustainability and uses an integrated approach that combines the traditional perspective of fiscal and public debt policy analysis (financial sustainability) with the challenges of climate transition and the physical effects of climate change. This implies that fiscal and debt policy must be consistent and contribute to the urgent and profound transformations required in production and consumption patterns to address the threats arising from the unsustainable use of natural resources (environmental sustainability) and a complex matrix of negative externalities.

The relevance of this topic is underscored by the significant increase in the frequency and intensity of climatic phenomena in most of the region's countries (droughts, floods and extreme weather events). These climatic phenomena have strongly impacted the general level of economic activity and social welfare.

The focus of the work lies on defining an analytical framework to evaluate the situation of public finances in the region's post-pandemic economies, and on identifying the possibilities and risks offered by new fiscal and financial instruments to face the challenges posed by the response to climate change in the medium and long term.

With its differences per country, Latin America has made significant economic and social progress over recent decades. This is supported by relatively volatile economic growth that is subject to various external and internal shocks. However, these advances are not enough to resolve the various structural problems (such as chronic poverty, high-income concentration) and the threat of multiple negative externalities (such as atmospheric pollution and greenhouse gas emissions), that are eroding the possibilities for economic and social development.

Public finances and the management of public external debt in Latin America face important challenges in this context, including overcoming the chronic weakness of the reduced fiscal space, which is based on both low tax collection in some cases and on growing demands for public spending in others, which results in fragile fiscal balances. Thus, various external or internal shocks result in high and volatile public deficits that are passed on to public debt. This situation leads to macroeconomic imbalances that have a negative impact on economic dynamism.

This fragility of public finances has intensified as a result of:

- The COVID-19 pandemic that reduced tax revenues and generated additional pressures on spending levels, e.g., to support economic recovery.
- High international interest rates have led to increases, in some cases significant, in public debt service payments.
- Significant volatility in the prices of the primary products that are exported by the region's countries, which in some cases represent an important source of fiscal resources.

- Recent increases in fuel prices have caused difficulties in the alignment between climate objectives that are consistent with the deep decarbonization of the economy and the macroeconomic policies implemented to address the inflationary pressures that have affected many countries in the region since the end of 2021 (fiscal and political difficulties in managing specific tax policies and fossil fuel subsidies).
- Climate change which is putting pressure on public finances through different channels, causing significant losses in tax revenues and an increase in public spending requirements to address these climate shocks, which normally result in an increase in the public deficit.
- The fiscal requirements necessary for building a carbon-neutral economy between 2050 and 2070. This implies recognizing the presence of new patterns of spending and tax revenues, and the presence of significant stranded assets (in countries and regions based on extractive activities) that have a negative impact on economic activity and public finances.
- Natural disasters that temporarily generate reductions in tax revenues and increases in public spending.

This situation poses a new challenge for Latin America's fiscal policy and public debt management. In fact, fiscal policy and public debt management currently show significant fragility. They will, however, have to face the challenge of contributing to the achievements of the 2030 agenda of the Sustainable Development Goals (SDGs), of greater post-pandemic economic dynamism and at the same time, address the challenges posed by the high vulnerability to the negative effects of climate change.

To meet these challenges, a new sustainable fiscal and public debt management strategy is required to increase fiscal revenues, reorient public spending, make fiscal space more flexible, contribute to preserving macroeconomic balances and generate a new profitability matrix consistent with the objectives of the climate transition. The construction of this climate-resilient and carbon-neutral economy also requires considering indispensable aspects of the transition to sustainable development, manifested in income distribution inequality, high and persistent poverty levels, and multiple gender inequalities.

The capacities, possibilities and constraints for fiscal and public debt policy in the context of climate change can be identified based on the analysis of physical and climate transition risks.

The impacts on public finances, derived from events related to climate change and the transformations required to move towards carbon neutrality, can be determined from the repercussions of these events on the global GDP and on the activities that are most directly involved in the climate transition. These are expressed in terms of lower public revenues (tax and non-tax) and in the greater public spending effort required to accelerate the processes of mitigation and adaptation to climate change. The widening of deficits will, in turn, require greater use of financing.

The proposed approach makes it possible to identify, characterize and quantify the importance of the different types of fiscal risks that the region's countries face in the context of a just climate transition. This by considering both public revenues from the sectors and activities that are most intensive in greenhouse gas (GHG) emissions and the importance of the effects of climate and environmental events on the level and composition of public spending. The analysis of public finances must consider the physical risks of climate change and transition risks, thus contributing to the joint and simultaneous integration of the dimensions of financial and environmental sustainability.

From a financial point of view, the study of current and foreseeable fiscal risks must be integrated with the analysis of the instruments that are available to governments to meet their growing financing needs. The management of public indebtedness and the way in which sovereign debt restructuring problems will be addressed in the future must also consider the new opportunities that have opened up by the transformations in international capital markets over recent years and multilateral financial organizations' increasingly important commitment to sustainable development.

The paper is organized as follows. Section 2 summarizes the importance of the just climate transition for the definition of public policy strategies in Latin America and presents the main challenges this implies for fiscal policy and public debt management. The third section analyzes the different types of fiscal and financial risks related to climate transition and presents the relevant climate scenarios for the analysis of their dynamic effects. Section 4 presents a typology of fiscal risks and discusses their methodological implications in terms of public debt financial sustainability simulation exercises. The fifth section considers the role that new forms of climate and sustainable financing could play in enhancing the capacity of the region's governments in the face of climate change. Section 6 considers how the reorientation of fiscal policies and public debt management strategies could help ensure the compatibility of financial sustainability and the sustainable use of natural resources that is required to move towards carbon neutrality by 2050 - 2070. The last section provides a synthesis of the paper's content and some final considerations regarding the challenges of fiscal policy and public debt management in the face of climate change.

II. CLIMATE TRANSITION AND FISCAL POLICY

Latin American countries face important development challenges in the context of a new 21st-century global economy that expresses itself through various paradoxes and contradictory situations. During the last two decades, the economies of the region have experienced continuous, albeit considerably volatile, levels of economic growth that have led to increases in per capita income, consumption and employment, and social improvements that can be expressed in terms of poverty reduction and, in some cases, improvements in income distribution.

However, this dynamism has been insufficient to address the chronic problems associated with very high levels of economic and social vulnerability affecting broad sectors of the population and a high concentration of income and wealth. The development style that predominates in the region is generating a complex matrix of negative externalities associated with, for example, atmospheric pollution, soil erosion, deterioration of water resources and the generation of GHG emissions that cause climate change. These negative externalities also undermine the foundations of the development process, conditioning and limiting the prospects for economic growth in the coming decades (Stern, 2006).

These development paradoxes have been greatly intensified by the deterioration in the quality of global public goods, such as public health (COVID-19) or the climate (climate change). From the point of view of public policy strategies, the scenario becomes even more challenging insofar as the pandemic has reduced fiscal space and has increased levels of public debt, reducing the maneuvering capacity of fiscal policy to act on externalities and to promote the structural transformations required to move towards environmentally sustainable and socially inclusive development.

Climate change has significant, widespread and more intense negative effects on economic activities in poorer and warmer countries or regions, severely impacting social conditions and the environment. At the same time, the 2015 Paris Agreement on Climate Change establishes the goal of temperature increase between 1.5° C and 2° C, for which a carbon-neutral economy must be achieved between 2050 and 2070. This means that climate change represents an obstacle to development (Dell et al., 2014), and it places the role of meeting GHG emissions mitigation targets and building a climate-resilient economy high in a hierarchy. Available data estimate the fiscal effort required by 2030 to effectively address the emerging risks matrix that is associated with climate change range, depending on the country, between 2% and 8% of GDP for investment in infrastructure and between 2% and 5% of GDP to address social challenges if solid economic growth is to be achieved. Even greater efforts will most probably be required if long-term environmentally sustainable development is to be achieved (see Galindo et al., 2022). The fiscal policy response that is needed to deal with the economic and social repercussions of these extreme events requires between 0.2% and 0.3% of GDP annually, which represents about one-tenth of the average fiscal deficit (2.6% of GDP) and is directly passed on in the form of increases in public debt (Delgado et al., 2021).

The implementation of a fair transition to a carbon-neutral and climate-resilient economy implies deploying a new development strategy in which fiscal policy and public debt management must prioritize the urgency of mobilizing resources to carry out the required structural transformations in the production and consumption patterns that prevail in the region's countries. In this context, it is essential to build a new fiscal and public debt management policy consistent with the fulfillment of climate change and sustainable development objectives.

Fiscal and public debt conditions show marked heterogeneity among Latin American countries. The diversity of situations is manifested in terms of differences in fiscal pressure indicators and in the disparate possibilities of allocating greater public resources to meet the economic, social and environmental challenges associated with a just climate transition. Reality shows that prudent fiscal policy management and the financial sustainability of public indebtedness are fundamental pillars of macroeconomic stability and predictability. It is also well known that the counter-cyclical use of fiscal policy depends, to a large extent, on access to financing, which in itself depends on the responsible and prudent management of public finances.

Fiscal imbalances can eventually result in external imbalances and unsustainable increases in public debt, which can be expressed as an effective restriction on the possibilities of economic growth (Chudik et al., 2017). The perception that public debt management is unsustainable also usually implies increases in interest rates which has an impact in terms of reduced private investment (crowding out) and lower consumption, given the expectation of higher taxes.

The relationship between public debt and economic growth is, of course, far from linear, and the limits or inflection points in the relation between the path of indebtedness and GDP are highly debatable (Chudik et al., 2017). In the specialized literature, some estimates indicate that a level of public debt/GDP ratio above 90% would result in a decline in the average annual GDP growth rate of between 1% and 1.5%, compared to those countries with ratios below 90% (Reinhart and Rogoff, 2010). Some authors, however, argue that there is no specific public debt/GDP ratio level at which negative effects on economic growth would manifest themselves. Moreover, controversy persists among experts in the field as to whether the level of public debt becomes sustainable when the real interest rate is lower than the GDP growth rate at constant values (Blanchard, 2019; Siddique et al., 2016; Asteriou et al., 2021; Blanchard, 2022).

In any case, increases in public debt reflect macroeconomic imbalances that limit the capacity of fiscal policy to contribute to greater economic dynamism and to address various social and environmental challenges (for

example, in the creation of new economic, social and environmental infrastructures). This results in increases in public debt-to-GDP ratios that lead to a reduction in financial rankings (World Bank, 2021).

Within the framework of a just climate transition, the region's countries need to address the challenge of building a new fiscal policy and a new public debt management strategy consistent with the construction of a climate-resilient and carbon-neutral economy in this century. They can do this by intensifying the use of new tax, fiscal and financial tools that connect the management of public finances with a just climate transition.

In order to move in this direction, the following aspects must be considered:

- The implementation of a new comprehensive fiscal strategy aimed at generating the necessary resources to support post-pandemic economic reactivation and to address the challenges of climate change (mitigation and adaptation). Considering that the current fiscal space is limited, it is necessary to integrate a fiscal strategy that contributes to the reactivation while promoting the structural transformations needed to move towards a low-carbon and climate-resilient economy (Hepburn et al., 2020).
- The implementation of specific actions that address the physical risks and the risks of a just climate transition, considering the potential consequences of increased public spending to support it, the implementation of a green or environmental fiscal strategy with its potential consequences for output and income distribution, as well as the potential consequences of the accelerated loss of tax revenues from carbon-intensive activities (stranded assets). To this end, the new fiscal policy should be consistent with sustainable development, which implies introducing innovations in the tax structure, where environmental taxes are essential, and processing a progressive redefinition of priorities in public spending (Ruiz-Huerta et al., 2022).
- The implementation of public debt management that integrates the opportunities offered by climate and sustainable financing to improve the conditions for accessing new sources of revenue in terms of interest rates, periods and currency denominations, incorporating explicit commitments and specific actions to achieve climate goals and to comply with the sustainable development goals of the 2030 Agenda.

III. PHYSICAL AND CLIMATE TRANSITION RISKS

The analysis of physical risks and climate transition on fiscal policy and public debt management can be approached in a methodological context that is, essentially, similar to that used to assess risk scenarios in financial systems (NGFS, 2019; NGFS, 2021). Physical risks are directly related to the effect of climate change's negative externalities on the functioning of economies, and that are expressed in terms of reduced possibilities for economic growth on a global scale. Climate transition risks are related to the impact of changes in production and consumption patterns on public finances, linked to the necessary change in the orientation of public policies and adjustments in the behavior of private agents, which includes the incorporation of technological and market changes.

The available evidence shows that the physical risks of climate change are significant and that these have important implications for fiscal policy and public debt management (NGFS, 2021). These risks originate in global warming and are expressed through a progressive decline in the average annual GDP growth rate or in the level of activity, affecting social welfare and the environment (Dell et al., 2014; IPCC, 2014). The incorporation of these risks in economic policy decision-making requires consideration of their potential repercussions. These are usually manifested through transitory or permanent increases in public spending and decreases in tax revenues derived from the reduction of potential GDP growth prospects. In both cases, lastly, the effects are manifested by increases in fiscal deficits and public debt (Delgado et al., 2021).

There are also significant climate transition risks (public policy, technological, market and reputational) for public finances arising from countries' commitments under the Paris Agreement to contribute to accelerating the transformation process to a carbon-neutral economy between 2050 and 2070.

This just climate transition implies a significant increase in public investment in infrastructure and leads to an accelerated depreciation or loss of assets in carbon-intensive activities (stranded assets). In some cases, climate transition risks result in the closure of certain activities in, for example, the fossil fuel sector (oil and gas). These developments will have a major impact on public finances insofar as they will result in a significant reduction in fiscal revenues from taxes and royalties that are collected on these activities.

In this context, it is essential that countries have an analysis of the risks of the climate transition for the current fiscal and public debt strategy in place and that they possess a new fiscal and public debt management strategy that is consistent with a just climate transition towards a carbon neutral and resilient economy. This strategy should contribute to a broad mobilization of fiscal and financial resources and should be aimed at generating a new matrix of economic incentives.

III.1. PHYSICAL RISKS OF CLIMATE CHANGE

Climate change is a development issue that has negative effects on a range of economic activities, affecting social welfare and the environment (Dell et al., 2014; IPCC, 2014). Recent estimates indicate that climate change has widespread, possibly non-linear negative effects that cause irreversible damage and that this is more intense in poor countries and in countries with warmer climates, impacting their capacity for long-term economic growth.

Climate change has a particular a negative impact on multiple productive activities - agricultural, industrial and services -, on energy and water demand, and on poverty. It increases distributive inequality, and it has significant consequences that affect the health of the population and intensify the effects of atmospheric pollution that cause health concerns derived from heat waves that stimulate migratory flows, and that affect ecosystems and biodiversity (see IPCC, 2014; Dell et al., 2014; Burke et al., 2015).

In the case of Latin American countries, there is evidence that indicates that climate change has caused a considerable increase in the frequency of extreme weather events, which regularly affect activity levels beyond considerations related to the deterioration of potential economic growth rates (Delgado et al., 2021).

There are multiple estimates of the impacts of climate change on either the output level or the output growth rate. These impacts of climate change on the long-term growth rate are particularly relevant insofar as they condition long-term growth prospects. In the estimates of the impacts of climate change on output growth

rates, Acevedo et al. (2018) of the International Monetary Fund stand out who estimate that a 1° C increase in temperature would result in a 0.9% reduction in the annual global growth rate and with a greater effect on growth prospects of 1.2% in developing countries. Dell et al. (2014) estimate that a temperature increase of 1° C would result in a 1 - 2% reduction in growth rates in poor countries (see Table 1).

The physical risks of climate change have consequences for public finances, which are expressed through **losses in fiscal revenues** as a result of the fall in GDP and the decline in potential growth rates, especially affecting activities that account for a significant proportion of tax revenues and resources from royalties from extractive activities. In addition, the physical risks of climate change directly or indirectly lead to **increases in public spending** to finance mitigation and adaptation processes and to deal with the emergencies (productive or social) caused by extreme weather events.

Table 1. Temperature increase and effects on output growth rate.

Temperature increase		Impact on GDP
Dell et al. (2014)	1 C°	between -1% and -2% in the growth rate of poor countries.
Dell et al. (2009)	1°C	-1.4% in the per capita income growth rate of poor countries.
Dell et al. (2012)	1°C	between -1.35% and -1.39% of global GDP; -2.66% in agricultural GDP; -2.04% of industrial GDP in poor countries.
Acevedo et al. (2018)	1 C°	-0.9% of the global growth rate and -1.2% in developing countries.
Kahn et al. (2019)	1 C°	-1.03% in the overall GDP growth rate.
Jain et al. (2018)	1 C°	-2.5% in India's GDP growth rate
Jain et al. (2020)	1 C°	-2.5% in India's GDP growth rate.
Jones and Olken (2010)	1 C°	between -2.0% and -5.7% in the average growth rate of exports from poor countries.
Colacito et al. (2019)	1 C°	between -0.27% and -0.45% of the U.S. GDP growth rate.
Hsiang (2010)	1 C°	-2.4% in the rate of product growth.

Source: Authors' elaboration.

Ultimately the physical risks of climate change are expressed through increases in fiscal deficits. It is estimated that in Latin American and Caribbean countries, extreme climate effects cause a reduction in public revenues of between 0.8% and 1.1% of GDP in lower-middle-income and low-income countries, respectively, with a limited effect in terms of increases in public spending. As a result of these effects, there would be increases in the fiscal deficit equivalent to 0.8% of GDP for lower-middle-income countries and 0.9% of GDP for countries in the low-income group (Delgado et al., 2021). These authors also estimate that between 2001 and 2019, extreme weather events in LAC had an annual fiscal impact averaging between 0.2% and 0.3% of GDP, which represents about 10% of the average fiscal deficits observed in the region's countries (2.6% of GDP).

III.2. CLIMATE TRANSITION RISKS

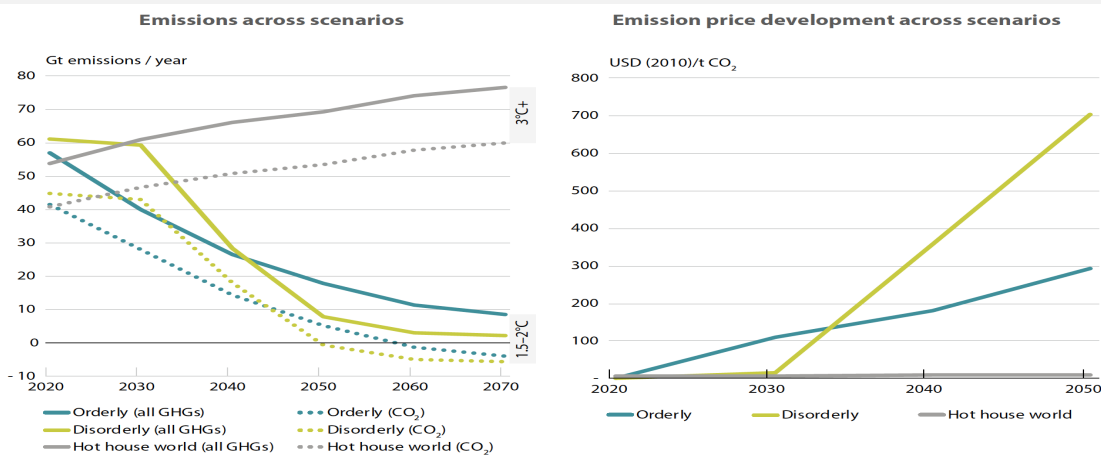
The Paris Agreement on climate change seeks to stabilize the global temperature increase between 1.5° C and 2° C for this century, which requires the global economy to be carbon neutral between 2050 and 2070 (IPCC, 2018). This should enable avoiding the most intense or irreversible negative impacts that are even having an impact on development capacities (IPCC, 2014; Burke et al., 2015).

Following the guidelines established in NGFS (2019) and NGFS (2020), the analysis of these climate transition risks is usually performed by considering a set of mitigation scenarios (see Figures 1 and 2) that are related to specific increases in temperature rise. This prospective analysis of climate scenarios usually considers the following trajectories (see Table 2):

- **Orderly scenario:** implies that the economy is carbon neutral between 2050 and 2070 and where mitigation processes are initiated in the present in an orderly and efficient manner.
- **Disordered scenario:** implies that the economy is carbon neutral between 2050 and 2070 and where mitigation processes begin after 2030.
- **“Too little too late” scenario:** current public policies are applied, but a carbon neutral economy is not achieved between 2050 and 2070.
- **“Hothouse world” scenario:** the non-implementation of mitigation strategies and evidently climate goals are not met.

For a scenario of a 1.5° C temperature increase, the decarbonization scenarios imply that by 2030 CO₂e emissions will be 45% lower than their level in 2010 and reach zero net emissions between 2045 and 2055. For the 2° C temperature increase scenario, CO₂e emissions should be reduced by 25% by 2030 and reach zero net emissions between 2065 and 2080. This means, in general, zero net emissions *per capita* in advanced economies and less than 2.0 tCO₂e *per capita* in emerging and developing economies by 2050 (IEA, 2021).

Figure 1. Climate Transition Risk Scenarios

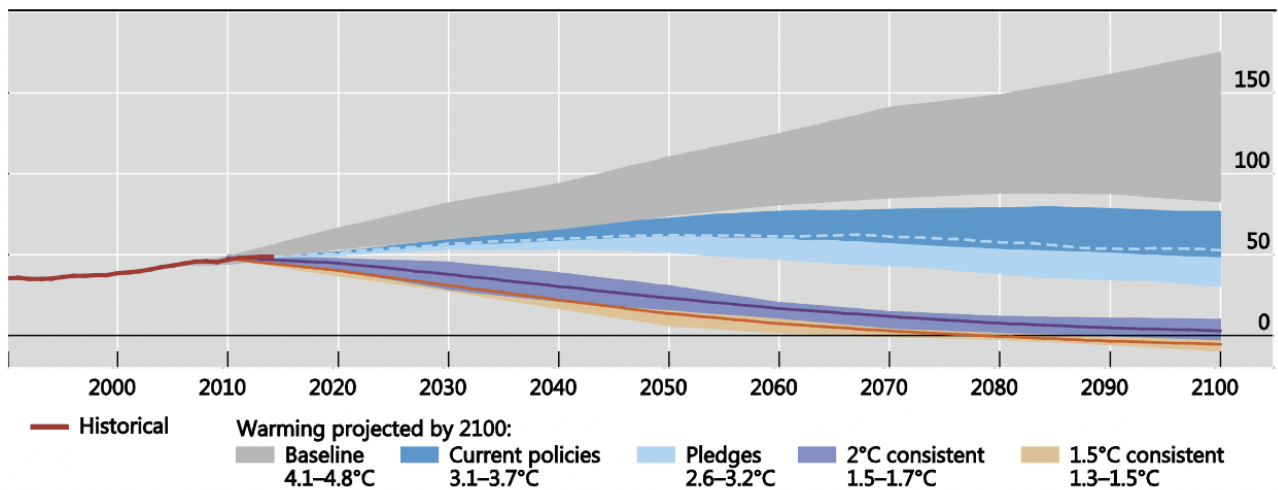


Source: NGFS (2020)

Figure 2. Decarbonization trajectories of the global economy

2100 warming projections: emissions and expected warming based on pledges and current policies

Global greenhouse gas emissions (GtCO₂e/year)



Source: Bolton et al. (2020) "The green swan: Central banking and financial stability in the age of climate change".

Table 2. Basic assumptions of the climate scenarios

	Orderly Scenario	Disorderly Scenario	Too little, too late and Hothouse world scenarios
Temperature increase target	1.5° C - 2 C°	2 C°	
Emissions	Emissions peak before 2030	Emissions peak after 2030	Emissions maintain a trajectory consistent with current public policies and/or no action taken
CO ₂ e per capita	Between 2 and 0 in 2050	Between 2 and 0 in 2050	Unrestricted
Public Policies	Immediate mitigation policies	Public policies for mitigation after 2030	Current policies – Business as usual
Carbon price	USD 10 tCO ₂ e each year in the immediate future	USD 35 tCO ₂ e each year after 2030	CSC: USD 0-30 tCO ₂ e. Possible between USD 40 to USD 80 tCO e ₂

Source: Authors' elaboration

This deep decarbonization process requires electricity generation to come from renewable energies and all economic activities and transportation to be electrified (IEA, 2021; IPCC, 2018). This means the termination, or a significant reduction, of the production and use of fossil fuels. IEA (2021), for example, assumes in deep decarbonization scenarios that there is no additional investment in oil and gas production and that demand for fossil fuels is drastically reduced. In this case, 60% to 90% of electricity generation should come from renewables by 2050 (IEA, 2015; IPCC, 2018; IEA, 2017; IRENA, 2018), and by 2050, electricity should account for at least 50% of energy consumption (IEA, 2021).

To move in this direction, it is essential to intensify decarbonization rates in the transport sector which requires a 95% reduction in emissions by 2050 (20% by 2030) (IEA, 2021; IPCC, 2018) due to an increase in the sale of new hybrid or electric cars. These will come to represent between 50% and 60% of new car sales between the years 2030 and 2035, in reference to 5% in 2020, and practically the total number of cars sold from 2035 onwards. Thus, electric cars will represent 20% of the cars in circulation in 2030 and 60% in 2040 (IEA, 2021).

The agricultural sector, on the other hand, needs to stabilize or even reduce the expansion of the agricultural frontier, increase productivity and modify consumption patterns, while most of the buildings should be carbon neutral by 2050 (IPCC, 2018).

The accelerated transition to a carbon-neutral economy between 2050 and 2070 presents several risks that are concentrated in the following (NGFS, 2019):

- **Changes in public policy** aimed at achieving a carbon neutral economy between 2050 and 2070, which should be reflected, as an illustration, in the definition of a carbon price.
- **Technological obsolescence**, caused by the introduction of innovations that may render current production processes incompatible with certain goods and services as a result of companies' greater commitment to environmental sustainability.
- **Changes in market conditions**, associated with changes in consumer habits or preferences towards products and services with lower carbon content (greener or more sustainable).
- **Growing importance of reputational considerations on the part of companies** that is driven by consumer perceptions that certain consumption is unsustainable - or carbon-intensive - and therefore incompatible with carbon neutrality.

The fiscal policy and public debt risk analysis is synthesized based on heat maps considering the definitions in Table 3.

Heat maps

<i>Definition</i>	<i>Color</i>	<i>Comments</i>
Low risk		Risks that can be managed in the context of current risk management.
Medium irrigation		Risks that require changes in current risk management.
High risk		Risks that require new risk management.
No additional risk		Risks under current risk management.

Source: UNEP-FI (2018)

IV. PUBLIC FINANCE AND CLIMATE CHANGE RISKS

For Latin America, physical and climate transition risks have important consequences for fiscal and public debt conditions, affecting fiscal policy and public debt management to varying degrees, depending on the specific characteristics of the countries' production and consumption patterns, and fiscal and budgetary structures.

IV.1. IMPACTS ON TAX REVENUES AND PUBLIC SPENDING

Schematically, the physical and climate transition risks manifest themselves in public finances in terms of decreases in tax revenues and increases in public spending associated with five factors.

1. Fiscal losses caused by the physical impacts of climate change on all economic activities, social welfare, the environment, and ecosystems. This risk results in tax revenue losses and, in some cases, higher public spending requirements. This situation leads to increases in fiscal deficits and public debt, which is evident in the case of extreme climate events (Delgado et al., 2021).

2. Reduction of fiscal revenues (tax and non-tax) due to the configuration of a wide variety of stranded assets in productive activities with high carbon content. This risk is stronger in oil and gas production activities. Current global hydrocarbon production forecasts are inconsistent with the Paris Agreement on climate change and would lead by 2030 to CO₂e emissions that are more than double those committed to when wanting to reach the 1.5°C temperature increase target (SEI et al., 2019). In the case, that the temperature increase is limited to 2°C, McGlade and Ekins (2015) estimate that 39% of oil reserves, 53% of natural gas reserves and 51% of coal reserves will become "stranded assets". For some of the

region's countries these risks would represent a significant loss of oil revenues and, therefore, of fiscal resources. Under climate transition scenarios, oil production in Latin America will have to be reduced by 2035 to less than 4 million barrels per day, which represents approximately 60% less oil production than that of the time prior to the Covid-19 pandemic (Solano-Rodriguez et al., 2019). This process could be particularly challenging for countries with oil exports and fiscal revenues derived from fossil fuels (Delgado et al., 2021). Estimates, which oscillate as a consequence of international oil price swings, indicate that public revenues from oil and gas exploitation represented between 2013 and 2008 on average 8.3% of public revenues in Bolivia, 8.0% in Ecuador, 6.6% in Trinidad and Tobago, 5.4% in Mexico and 2.5% in Colombia. In addition, in 2017, oil accounted for 98% of export revenues in the Bolivarian Republic of Venezuela (OPEC, 2017; Delgado et al., 2021). In a significant number of countries in the region, this reduction in fiscal revenues particularly affects sub-national governments, which see their resources from royalties generated by carbon-intensive activities either reduced or affected by the decrease in transfers from the central government. Climate transition thus implies a significant loss of fiscal revenues for some countries, which must be compensated to avoid an imbalance in the fiscal deficit and a disproportionate increase in debt as a proportion of GDP.

3. Decrease in tax revenues from collecting selective taxes on the consumption of fossil fuels, vehicles and other taxes on carbon-intensive goods and services. In all the region's countries, the collection of excise taxes on fossil fuels, vehicles and other carbon-intensive goods and services represents a significant percentage of tax revenues. Therefore, efforts to mitigate GHG emissions would have significant direct impacts on current tax collection levels. For example, tax revenue from IEPS on gasoline and diesel represented 1.6% of GDP in Mexico in 2019 (SHCP, 2019), of 0.74% of GDP in Argentina in 2020 (Ministry of Economy, 2020) and close to 1% of GDP in Chile in 2014 (Morales, 2018). Vehicle tax revenue in Mexico stood at 0.07% of GDP in 2018 (Cernichiaro, 2021), which is 2.4 times lower than the OECD average, and for Argentina at 0.26% of GDP in 2020 (OECD, 2022). Chile, with an environmental tax on mobile sources, collected in 2017 0.04% of GDP (García, 2018).

4. Expansion of public spending on fossil fuel consumption subsidies, the cost of which depends on international oil and gas prices. In several region's countries, the increase in the international oil price may lead to an increase in consumption subsidies. The current fossil fuel subsidy in Latin America, for example, is estimated to be around USD 46 million (Coady et al., 2019). It is important to remember that the amount of fossil fuel subsidies in the region is estimated to average about 1% of GDP in Latin American countries, though in some countries, the fiscal cost of policies is considerably higher (Delgado et al., 2021).

5. Increased public spending to promote a just climate transition. Recent estimates for countries in the region indicate that meeting the challenges of climate change will require annual investments in infrastructure of between 2% and 8% of GDP, most likely 5% of GDP, and the financing of social protection systems to ensure the population's access to basic benefits would require between 2% and 5% of GDP, with significant differences by country, of course. Thus, a just climate transition involves, up to 2030, an annual expenditure of at least 5% to 7% of GDP. Part of this expenditure is already being carried out.

It can be noticed that each area in which climate change risks manifest themselves, has an impact on fiscal revenues (tax and non-tax) and public spending (current and capital). Table 4 presents a summary of the (qualitative) effects of the different factors considered in the proposed typology. In all cases, without specific actions to increase fiscal resources or reduce (redirect) public spending, fiscal risks imply higher primary deficits and increases in public indebtedness, which may threaten the financial sustainability of public debt.

Table 4. Summary of the expected impact of climate risks on public finance

	<i>Physical risks</i>	<i>Stranded assets</i>	<i>Selective consumption taxes (reduction)</i>	<i>Subsidies to fossil fuels (increase)</i>	<i>Just climate transition</i>
Tax collection	(-)	(-)	(-)	n.c.	n.c.
Non-tax revenues (royalties, operating fees, etc.)	(-)	(-)	n.c.	n.c.	n.c.
Current expense	n.c.	n.c.	n.c.	(+)	(+)
Capital Expenditures	n.c.	n.c.	n.c.	n.c.	(+)
Primary fiscal result	(-)	(-)	(-)	(-)	(-)
Public indebtedness	(+)	(+)	(+)	(+)	(+)

Source: Authors' elaboration

In this context, using simulation exercises based on traditional methodologies of public debt sustainability analysis (see Annex 2) could provide valuable information on the implications of physical and climate transition risks on fiscal policy and on the role that could be played by an environmental fiscal reform that incorporates environmental considerations in the design of new tax tools. This type of analysis can help to estimate the potential fiscal costs of different types of risks and to measure the size of the fiscal efforts that are needed to meet the decarbonization goals of the economy for the 2050 to 2070 horizon.

In fact, climate transition provides an opportunity to generate new tax revenues derived from a green fiscal strategy that contemplates an increase in taxes on negative externalities associated with the environment. In current tax debates, the proposal to introduce a carbon tax is gaining increasing importance to underpin the process of reducing GHG emissions and as a possible source of financing to meet the increases in public spending required to support the climate transition. In this regard, recent studies suggest that a tax of USD 40 tCO₂e on fossil energy could raise around USD 69 billion annually in Latin America and the Caribbean (Coady et al., 2019).

IV.2. PUBLIC INVESTMENT AND GENDER EQUALITY CHALLENGES

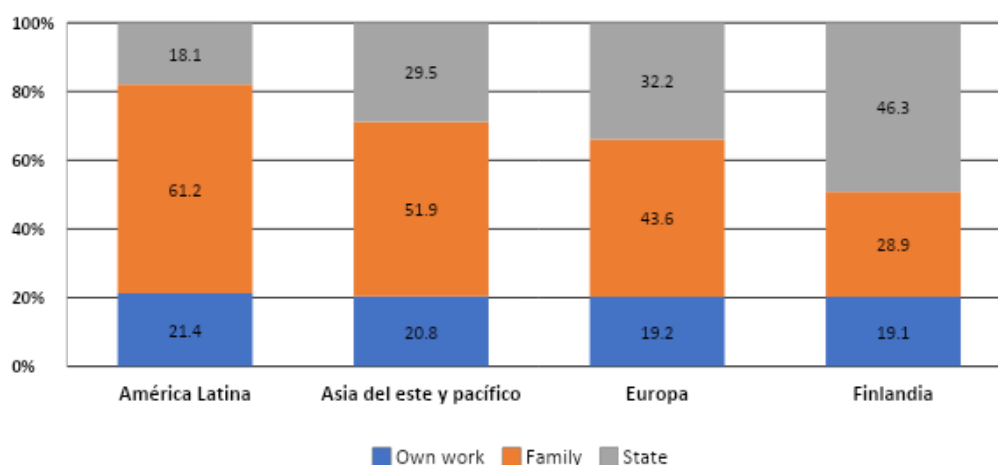
A just climate transition includes addressing the challenge of gender equality in Latin America. The social strategy in the region was, in effect, based on the construction of three main pillars: an education system, a health system and a pension system, usually accompanied by a contributory system. However, a fourth pillar, fundamental for achieving sustainable development, was not developed: a universal care system for children

and the elderly that can contribute to both better economic and social dynamics and promote gender equality.

Currently, gender inequalities are unacceptable from a human rights perspective and, in addition, have high economic and social costs. In Latin America, there is, for example, a feminization and infantilization of poverty, a gap in women's participation and wages in the formal labor market, and unacceptable conditions of violence against women. Addressing these gender inequalities and gaps, asymmetries in time use and time constraints, and the presence of unpaid childcare work and gender-based violence, is extremely complex and requires the application of various strategies on several fronts. In this context, one option is the construction of a universal childcare system considering that:

- Care systems contributed to reduce child poverty levels and raise their lifetime productivity and income (Heckman *et al.*, 2010; Heckman *et al.*, 2013).
- Intergenerational economic flows have a significant effect on economic dynamics and social welfare. Income and expenditure patterns of the population change throughout its life cycle. Infants and older adults, for example, consume more than they earn, while adults and young people earn more than they spend. These processes of intergenerational transfers from adults to infants and the elderly have an impact on economic dynamics, welfare levels and levels of inequality. The available evidence shows that in Latin America, where the public financing component is lower than in Europe and Asia, the financing of children and adolescents' consumption basically depends on families (Figure 4).
- Gender gaps in participation and wages in formal labor markets derive, among other factors, from asymmetrical participation in time use. That is to say that it is common for women to cover childcare by imposing time restrictions that do not allow them to participate in labor markets under equal conditions as men.
- A demographic bonus to help increase women's participation in the formal labor market. This also contributes to a more integrated society with lower economic and social risks and greater resilience to climate change.

Graph 4: Sources that finance the average consumption of children, adolescents and young people between 0 and 24 years of age.



In this sense, the elaboration of this social infrastructure is a fiscal measure that could create a triple dividend:

- Improve the well-being of infants and their future productivity and income.
- Reduce gender gaps in wages and labor participation and improve women's conditions.
- Contribute to boosting the economy and generating jobs.

The potential costs of this system are summarized in Table 5.

Table 5: Infant Care System Costs in Selected Countries

	South Africa (2017)	Turkey (2014)	Uruguay (2017)	United Kingdom (2014)
Participation rate	Universal	Universal	Universal	Universal
% of GDP	2.1%	2.0%	1.4%	0.4% 1.1%*

*Source: Table taken from Figueira et al. (2020) and De Heneau et al. (2019). In millions of dollars.
* In the United Kingdom, this includes the case of reduced unemployment payments and other benefits.*

Thus, an increase of 1.5% of GDP is considered for the construction of this social infrastructure. These amounts may represent the lower limit for some countries. This investment may also result from an adjustment to current public spending structures.

V. DEBT MANAGEMENT AND THEMATIC ISSUES

From the perspective of public debt management, the region faces a double challenge regarding sustainable financing. First, some countries, especially those with the greatest increases in their debt levels and those with significant financial requirements in the immediate future, will have to restructure their commitments to their creditors (private investors and multilateral financial organizations). Secondly, the restructuring of large public indebtedness appears as a dimension that affects macroeconomic stability, but may be an opportunity to undertake profound reforms in fiscal policies. In this context, possible negotiations on debt restructuring should be seen as an opportunity to make progress in environmental and social sustainability.

The transformations that have been taking place in the behavior of institutional investors and in the lending policies of multilateral financial organizations show that access to financing is increasingly related to debtor countries' commitments to climate change and the effectiveness of government actions regarding environmental and social sustainability. The adoption of a financing policy that explicitly incorporates the

sustainability of the type of development becomes, in fact, a fundamental axis of financial strategies. To move in this direction, the region's countries will have to mobilize resource flows under environmental and social criteria and objectives with concrete and verifiable positive impacts. Thus, the mobilization of financial resources must contribute to progress in closing economic and social gaps without compromising the sustainability of environmental resources.

A far-reaching financial transformation has begun to spread over the last two years, involving accelerated progress in the incorporation of sustainable development criteria in the decisions of institutional investors. Awareness of the threats posed by the current style of development on the economic and social future can be considered a milestone of great importance, which can accelerate the process of change in the behavior of companies, households and individuals, who serve as a backdrop for understanding the growing threats posed by climate change, and the extent of inequality under which large sectors of society have access to goods and services that are essential to ensure their well-being.

This process has been accompanied by the new strategies of international financial institutions, which, for some time now, have been incorporating the dimensions of environmental and social sustainability in their cooperation with countries. In fact, most multilateral financial organizations have incorporated "responsible and sustainable investment" standards in their resource allocations and loan disbursement programs. Financial innovations related to sustainable development are in a full expansion phase. It can even be argued that the rapid progress that is being made in financial markets is a lever that can accelerate the abandonment of practices and behaviors that are at the root of the unsustainable nature of the current (inertial) development trajectory.

The transformations needed to build a green, low-carbon and climate-resilient economy require a novel management of public debt and public finances. Indeed, public debt management must contribute to macroeconomic stability and remain at reasonable levels during the climate transition while at the same time open up greater opportunities for public debt, related to thematic financing and bonds, and a green fiscal policy.

The benefits that could be derived from the advance of sustainable finance are related to the permanent nature that the new conditions for access to sovereign financing seem to be acquiring. In fact, the current reality indicates that climate, environmental and social sustainability must be considered together with the intertemporal sustainability of public finances. The relevance of environmental, climate and social sustainability in financial management means that fiscal tools should be transformed and take on a more leading role with the development of transparent systems for programming, measurement, reporting and verification of a National Climate Change Policy.

To advance along this path, criteria and indicators for public debt management that are consistent with deep decarbonization and the construction of a new green economy, must be incorporated. This is related to the capacity to venture into thematic emissions (green, carbon or social) and international climate and sustainable financing. The intangible reputational benefits that countries could acquire by adhering to international climate change efforts should be added to the obvious financial advantages that would derive from new green financial practices (e.g. low-interest rates).

These aspects should produce changes in fiscal policies and public debt management. A fiscal expansion that is consistent with climate objectives should also consider the integral nature of the economic, social and environmental dimensions involved in sustainable development. It would be inconsistent to address environmental challenges without simultaneously tackling poverty and gender disparities. This implies using

fiscal instruments from which additional co-benefits can be derived. This would be the case, for example, when building an infrastructure that generates a double dividend from fiscal action, addressing negative externalities and, at the same time, contributing to economic growth, employment and better income distribution (Ekins and Speck, 2011). There are also fiscal policies that can contribute by means of the construction of a care system to improve gender equality. A national comprehensive care system, for example, would free up women's time so that they can enter the labor market under better conditions and thus contribute to closing the participation and wage gaps.

Public debt management must, undoubtedly, be framed within the framework of preserving macroeconomic stability. If the aim is to contribute to advancing climate and social objectives, it is, therefore, essential to generate the necessary fiscal space. This would imply implementing comprehensive green or environmental fiscal reforms or, at least, adjustments in the design of a set of tax instruments that contribute to the climate transition. An application consistent with social objectives requires contemplating the implementation of fiscal recycling policies to cushion negative social impacts.

VI. POST-PANDEMIC CHALLENGES

The extraordinary fiscal effort that governments have made to address the economic, social and health consequences of the Covid-19 pandemic has had a direct impact on public debt, particularly in the relatively less developed economies of Latin America. The need to address short-term emergencies, support the recovery of economic activity in the short and medium term and move towards sustainable development in the long term occurs in a context in which public debt as a proportion of GDP has sharply grown, and government financing requirements have reached historically high levels.

In this context, the sustainability of public finances becomes a key challenge for macroeconomic management. This is taking place under circumstances in which, on a global scale, governments are redoubling their efforts to respond to climate change (meeting specific mitigation and adaptation targets by 2030 and even reaching the goal of carbon neutrality by 2050) and to adjust their economic policy strategies to meet the challenges posed by the Sustainable Development Goals (SDGs) by 2030. In this context, those responsible for economic strategy will have to face the simultaneous challenge of preserving fiscal and macroeconomic sustainability as well as promoting the structural transformations required for a just climate transition, in which fiscal policy has a fundamental role to play.

Indeed, the management of fiscal policy and its financial counterpart, represented by debt management, requires addressing the challenges of financial, environmental and social sustainability. As never before, post-pandemic macroeconomic management should be defined with long-term development objectives in mind. Fiscal policy and public debt management should be responsible for stabilizing the economy and, at the same time, for promoting structural transformations in the shape of production and consumption habits that are compatible with sustainable development. It is difficult to imagine significant progress in terms of climate change mitigation and adaptation without a general overhaul of incentive systems for production and consumption and without redirecting tax instruments and public spending to facilitate changes in behavior that will lead to a development style that is compatible with environmental sustainability. Fiscal

transformations must consider the importance of introducing new green or environmental taxes and the potential consequences of a future loss of tax revenues while we move to a low-carbon, climate-resilient economy.

Over the last two years, a far-reaching financial transformation has begun to spread. It involves accelerated progress in the incorporation of sustainable development criteria in the decisions of institutional investors, which has been expanding to financial intermediaries that are operating with the private sector. Financial innovations related to sustainable development are in full expansion phase. It can even be argued that the rapid progress that is being made in financial markets is a lever that can accelerate the abandonment of practices and behaviors that are at the root of the unsustainable nature of the current development trajectory (inertial scenario).

Awareness of the importance of environmental and social sustainability issues is leading to a paradigm shift in global finance. Investors are prioritizing the factors that impact sustainability and are paying increasing attention to assessing the impacts of actions taken by governments and companies in their credit risk assessments and, more broadly, in defining their investment strategies. Environmental, Social and Governance (ESG) factors are now being adopted as standards by investors, institutional financiers and even traditional financial intermediaries (banks) in credit granting. Investors recognize these factors as indicators that add value to the economic and social development potential of countries. Investors are explicitly incorporating ESG factors into their investment analysis processes to the extent that they have created specific scoring systems to assess current and projected conditions in countries regarding the national environmental, social and institutional sustainability efforts, and to facilitate comparisons between countries. There is also growing concern among financial institutions and governments about the risks that climate change poses to the continued financing of certain types of investments. For example, the risk posed by the possibility of significant economic losses as a result of extreme weather events, or posed by the composition of various stranded assets that can no longer be used, such as investment associated with fossil fuels. These losses can have a significant impact on governments' fiscal revenues and expenditures, as well as on the situation of financial institutions.

The path to be followed by the region's countries implies not only changing fiscal and budgetary priorities but also requires moving towards a new institutional framework that establishes coherence between the policies applied and that develops coordination and cooperation mechanisms, both among government agencies and with the public sector and private actors. The relevance of environmental and social sustainability dimensions in the financial management of public debt is leading to greater interest on the part of the Ministries of Finance (who should transform fiscal and debt management tools and take on a more leading role in the development of transparent systems for programming, measuring, reporting and verification of the National Climate Change Policy) and of the Central Banks (who should incorporate environmental dimensions into their regulatory standards for local financial markets).

The benefits that could be derived from the advance of sustainable finances are related to the permanent nature that the new conditions for access to sovereign financing seem to be acquiring. In fact, the current reality regarding fiscal policy and public debt management seems to indicate that environmental and social sustainability should be considered simultaneously with the intertemporal sustainability of public finances. In addition to the obvious financial advantages that would derive from these new financial practices, there would be the intangible reputational benefits that countries could gain from adhering to international climate change efforts. It should, however, not be overlooked that public commitment to the sustainable development agenda is a necessary condition for the climate change mitigation and adaptation agenda, and for progress

towards the achievement of the SDGs and to incorporate the decision-making processes of the private sector, which is called upon to undergo major transformations in its investment, production and consumption behaviors.

In short, the construction of a new tax system that adapts to the challenges of sustainable development involves combining the necessary perspective of aligning instruments with the countries' long-term objectives with the contribution that these policies are expected to make in a macroeconomic scenario in which governments' priorities, inevitably, lie with the post-pandemic recovery.

The required adaptation of tax systems involves two different but mutually complementary perspectives. First, fiscal policy as a whole should integrate the social costs associated with correcting the enormous negative externality represented by climate change into the design of tax tools and the allocation of budget items. In this regard, the tax strategy should be directed towards influencing production and consumption patterns, aiming to consolidate the mitigation of greenhouse gas emissions and stimulating investments that lead to an improved adaptation of production systems to climate change. The relevance of the issue implies that various adjustments to the current tax system be contemplated, in addition to the creation of specific taxes to punish unsustainable consumption patterns and production processes, for example, by applying taxes on carbon emissions.

The necessary readjustment of countries' tax systems will have to be addressed in light of the medium-term consequences for tax revenues related to a climate transition to a low-carbon and climate-resilient economy. First, the use of taxes, which generate a new system of incentives and penalties on certain productive activities and on some types of consumption, will have to consider the medium-term effects of the erosion of the specific tax bases currently applied to energy and the use of fossil fuels. A necessary condition for preserving the environmental and social sustainability of national development strategies is that the available fiscal resources are sufficient. In this regard, it should be borne in mind that changes in fiscal structures could generate serious problems in the countries' public finances, constituting an additional macroeconomic risk that could compromise the sustainability of indebtedness. Secondly, the need to provide more and better public goods will have to be considered in the implementation of the redesign of fiscal instruments and this will necessarily require increases in the current levels of fiscal pressure. It is highly probable that the greatest needs for public resources will arise on a global scale, so that national efforts in this area will have to be developed in parallel with the progress of international cooperation in tax matters.

The design of a new system of incentives to sustainably stimulate production, employment, and exports must consider the consequences of the current economic crisis affecting the region's countries. This is expressed in terms of reduced room for maneuver for fiscal policy and the appearance of a new reality for restructuring and managing public debt. Consideration of these aspects is important when designing incentives for investment and production insofar as some of the instruments used to date have had high fiscal costs and, in some instances, have entailed very high levels of fiscal renunciation (tax expenditure). These incentives deserve to be reviewed in the context of a delicate macroeconomic situation such as those faced by the economies analyzed.

The redirecting of policies towards a better linkage with the goals of long-term development strategies implies explicitly contemplating the international commitments in the sphere of climate change assumed by countries (Nationally Determined Contributions, NDCs and the Long-Term Strategy) and the SDGs. In this sense, incentives, as well as the amount and structure of public spending, should be designed to address efforts to mitigate greenhouse gas emissions and prioritize adaptation to climate change. This comprises both the investment processes of private companies and the development of public physical and social

infrastructure projects. The available evidence in this area indicates that the response to climate change requires a more intensive use of fiscal tools and that the possibility of making progress in this area depends on the conditions for countries' access to financing.

VI. IN SUMMARY

In the immediate future, Latin America will have to shape a new, more active fiscal and public debt strategy to address the current economic, social and climate change challenges as well as various external shocks in order to move towards sustainable development that at the same time contributes to:

- economic recovery;
- improvement in income distribution;
- reducing negative externalities, including GHG emissions that cause climate change;
- the configuration of a new relative price structure and a new profitability matrix that is consistent with sustainable development;
- the climate transition to shape a carbon-neutral and climate-resilient economy by 2050 - 2070;
- the preservation of macroeconomic balances.

In its design, this new fiscal strategy should integrate:

- that the implementation of a green or environmental tax reform could generate "multiple dividends", thus allowing the control of various negative externalities, boosting economic growth and contributing to distributional improvements;
- that the environmental fiscal strategy could be made compatible with the widening of the room for maneuver for counter-cyclical action, favoring economic reactivation and promoting the structural transformation needed to build a carbon-neutral and climate-resilient economy;
- that linking public debt management with the objectives of a just climate transition will contribute to strengthening public finances, generating better conditions for access to financing in the capital markets (in terms of rates, interest rates, periods and currency denomination) and, at the same time, would achieve a more direct link with the sustainable development strategy.

The change of course in fiscal policy and public debt management in Latin American countries will imply a stricter alignment of public policy actions with the Sustainable Development Goals (SDGs) and the 2030 Agenda. The new direction of the fiscal strategy should be aimed at generating spaces to finance the increases in public investment in infrastructure that are required by the climate transition as well as the implementation of social policy reforms, prioritizing the gender equality agenda.

In this context, the consideration of the physical and climate transition risks should be incorporated in fiscal policy actions from its design stages, encouraging the adaptation of the different tax instruments and promoting changes in the composition of public spending.

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ANNEX 1 - ENERGY CONSUMPTION, PHYSICAL RISKS OF CLIMATE CHANGE AND PUBLIC FINANCES

A simple energy and climate change model can be used to identify the potential consequences of the physical risks of climate change on economic growth and, through this, on the principal magnitudes of public finances, in which mitigation scenarios can be analyzed.

The prospective analysis of the effects of the physical risks of climate change is based on simulations of the effects of climate change on the GDP growth rate in the context of the New Climate Economy, considering that an increase of 1° C in temperature by 2050 would lead to a gradual reduction in the GDP growth rate to 1% below the inertial trajectory (BAU) at the end of the period. Through the decline in economic growth, there is a proportional reduction in tax revenues.

The logic of the model aims to highlight that maintaining current patterns of production and consumption is not sustainable and will not allow for meeting the targets set out in the SDGs and the goals set out in the NDCs for 2030.

The analytical scheme used resorts to the IPAT identity (see Perman et al., 2003; Labandeira and Carmelo, 2007) which for greenhouse gas emissions from energy can be expressed as:

$$(A.1) \quad CO_{2t} = Y_t * \frac{EN_t}{PIB_t} * \frac{CO_{2t}}{EN_t},$$

where CO_{2t} represents greenhouse gas emissions from energy and EN_t is the energy use expressed in units of oil equivalent (kilograms). In rates of change the IPAT can be expressed as:

$$(A.2) \quad \Delta CO_{2t} = \Delta Y_t + \frac{\Delta EN_t}{\Delta PIB_t} + \frac{\Delta CO_{2t}}{\Delta EN_t}$$

The PRIMAP (2020) emissions database – historical national historical emissions time series- and the World Bank database were used to make the set of estimates compatible and to have updated information available over time.

The greenhouse gas emissions trajectories developed with the IPAT model allow us to identify the magnitude of the mitigation effort under various scenarios, like for example, the orderly scenario, which implies starting mitigation immediately to reach the goal of a carbon neutral economy in 2050, and the disorderly scenario, which implies starting mitigation in 2030 and reaching a carbon neutral economy in 2050.

The fiscal risk scenarios of the climate transition (NFGS, 2020) were elaborated considering a model of nine basic identities:

$$(A.3) \quad GDP_t = (1 + g)GDP_{t-1}$$

$$(A.4) \quad g_t = \frac{GDP_t}{GDP_{t-1}} * 100$$

$$(A.5) \quad gCC_t = D_t * g_t$$

$$(A.6) \quad YF_t = \frac{YF_t}{PIB_t} GDP_t$$

$$(A.7) \quad GP_t = \frac{GP_t}{GDP_t} GDP_t$$

$$(A.8) \quad DF_t = GP_t - YF_t$$

$$(A.9) \quad DEBT_t = DEBT_{t-1} + DF_t$$

$$(A.10) \quad RDF_t = \frac{DF_t}{GDP_t}$$

$$(A.11) \quad RDEBT_t = \frac{DEBT_t}{GDP_t}$$

where GDP_t is the Gross Domestic Product, g_t is the GDP growth rate in the inertial scenario (Business As Usual -BAU-), gCC_t is the GDP growth rate incorporating the impacts on the GDP growth rate, D_t is the climate damage function where the assumption is imposed that a 1° C increase in temperature implies a drop in the GDP growth rate of 1% per year on average, YF_t represents total tax revenues, GP_t is public expenditure, DF_t is public deficit and DP_t is public debt, RDF_t is the percentage of fiscal deficit to GDP, and $RDEBT_t$ is the percentage of public debt to GDP.

In this way, the model establishes an inertial scenario that is contrasted with various scenarios in which the parameters are modified up to 2050. The parameters are established based on judgments of their recent values. The parameters used are held constant throughout the simulation period. These scenarios are not projections and only seek to illustrate the long-term trajectories of various fiscal risks arising from the climate transition.

The prospective scenarios used are:

1. Inertial scenario (Business As Usual -BAU-). In this scenario, the current parameters are kept constant until 2050.
2. Physical climate change risk scenario. This scenario considers a gradual fall in tax revenues due to a reduction in the GDP growth rate. All other parameters are held constant.
3. Stranded asset risk scenario. This scenario contemplates the gradual fall in tax revenues due to the drop in oil and gas production. All other parameters remain constant.
4. Scenario of increased public spending for infrastructure. All other parameters remain constant.
5. Green tax reform scenario. This scenario results in an increase in tax revenues. All other parameters remain constant.

Care system construction scenario. This scenario considers an increase in public spending to support the construction of a universal quality care system. All other parameters are held constant.

ANNEX 2- PUBLIC DEBT SUSTAINABILITY

The analysis of the fiscal situation is key to assessing the macroeconomic prospects of an economy, especially in the case of small and open economies. The available empirical evidence indicates that a diagnosis of the fiscal situation constitutes a fundamental input when defining a country's macroeconomic strategy, even in times of stability. The study of the soundness of a country's macroeconomic policy framework requires a rigorous assessment of sovereign debt sustainability.

Public Debt Sustainability Analysis methodologies provide tools to assess the risks and vulnerabilities of fiscal policy. Debt Sustainability Analysis considers the debt position of the public sector and proceeds to assess the risks inherent in maintaining the fiscal policy path. This approach makes it possible to assess the need for changes in direction or adjustments in the fiscal policy stance applied. In Latin American economies, exposure to the risk of public debt crises is far from negligible: this is the predominant perception in international financial markets and lies at the basis of the criteria applied by risk rating agencies. Debt crises are usually costly, and, in general, their consequences have a wide-ranging impact on the economy as a whole as well as on social conditions. Given the range of areas of the economy and society that may be affected, it is difficult to precisely estimate the economic costs associated with the suspension of public debt payments. Public debt crises are usually associated with recessions, political crises and institutional deterioration. These crises have consequences on financial markets and call the reputation of governments into question, particularly in terms of their commitment to meeting their financial obligations.

Debt Sustainability Analysis methodologies generally provide tools for assessing the financial vulnerability of a government, regardless of whether the creditor is a domestic or foreign resident agent and whether it is a public or private entity. The approach generally applied does not pay particular attention to the jurisdiction where the debt was generated (particularly in the case of debt issued in the form of sovereign bonds). In countries that are financially integrated into global markets, there is a strong link between financial instruments that are issued domestically and those placed in international markets. This reality serves as a justification for Debt Sustainability Analysis to be based on the analysis of the aggregate of total public debt.

a) The concept of sustainability

Public debt is considered sustainable when its value as a proportion of GDP reaches a stable (or declining) trajectory over time. A variant of the concept of sustainability is the assessment of whether the debt has reached a level that is beyond the government's capacity to pay, measured by the primary surplus that the government has been able to generate historically. Some methodologies for studying debt sustainability emphasize risk analysis and calculate the probability that unfavorable shocks could increase debt values to levels that exceed the capacity to service it.

b) Methodological approaches

When analyzing the debtor position of a given economy, it is necessary to consider multiple aspects. The performance of economies is determined not only by domestic policies but also by the (exogenous) conditions of the regional and global context.

The "traditional analysis" of fiscal sustainability is based on comparative statics exercises, which consider isolated and independent shocks on a set of variables considered relevant for the determination of the

debt/GDP ratio (hereafter D/Y): interest rate, dollar inflation, real GDP growth rate. In this type of exercise, it is usually assumed that the rest of the variables involved in the system remain unchanged. This approach helps to draw conclusions about the fiscal situation of the economy under analysis. Analyses based on this methodology provide a reference framework for evaluating the sensitivity of the D/Y ratio path to variations in the macroeconomic environment.

An approach that contributes to enriching the "traditional analysis" of public debt sustainability must necessarily be based on a methodology that makes it possible to quantify the risks to which the D/Y ratio is exposed when facing changes in the relevant variables involved in determining its trajectory. It should be borne in mind that the analysis of the vulnerability of the D/Y ratio based on one or the other methodology may yield very different results.

c) Procedures available in the "IDB Template".

The methodologies and procedures for Debt Sustainability Analysis included in the "IDB Template" (IDB, 2010) available at the Debt Policy Directorate of the Ministry of Finance of Paraguay are as follows:

- i) Standard Approach.
- ii) Endogenous Debt Dynamics.
- iii) Sudden Stop.
- iv) Fan Charts.
- v) Natural Debt Limit.

The first three methodologies can be considered variants of the "traditional analysis" of debt sustainability. The so-called "Fan Chart" approach includes elements of methodologies that emphasize uncertainty analysis and therefore take aspects related to the dynamic interrelationships between the variables that influence the trajectory of the D/Y ratio into account. The "Natural Debt Limit" procedure has characteristics that distinguish it from "traditional analysis", though in essence, it shares common elements with the latter.

The "traditional" debt sustainability analysis is based on estimating the level of the primary surplus (fiscal surplus, excluding interest payments on public debt) that is required to keep the current debt-to-GDP ratio stable in the long run. The calculation of this level of primary surplus is usually based on the values of the long-term average levels of the GDP growth rate and the real interest rate of the economy.

The contribution of the so-called "Endogenous Debt Dynamics" model traces the trajectory of the D/Y ratio over time as a function of its direct determinants: primary surplus, interest rate, exchange rate and economic growth rate. The estimated trajectories adopt a medium-term approach, covering periods of between five and ten years. This procedure allows for changes in the determinants of public debt evolution over time, thus providing information on how the public debt trajectory is affected by different assumptions about the variables included in the analysis.

The procedure associated with the "Sudden Stop Model" provides estimates of the impact that the economy under consideration's loss of access to external financing may have on debt sustainability. The concept evokes episodes such as the 1994 Tequila crisis and the 1998 Russian/Asian crisis. This model considers different channels through which the sudden stop affects debt sustainability. This includes the exchange rate channel, which is particularly strong when a large part of the debt is denominated in a foreign currency.

The "Fan Chart" model incorporates the fact that the future evolution of the determinants of debt evolution (interest rates, growth rates, etc.) is uncertain and that the uncertainty, therefore, extends over the evolution of the D/Y ratio. Instead of projecting a single value of public debt for each year, a range of values for the D/Y ratio is provided based on the estimation of probabilities. In this type of exercise, uncertainty is amplified as the projection horizon is extended.

The "Natural Debt Limit" procedure calculates the maximum level of debt that the government would be able to cope with "absolute confidence" based on information about the "historical variability" of government revenues and expenditures. From this approach, it is possible to determine a level of debt that the government will "always" be able to cope with, even in situations of maximum fiscal stress. This level of public debt associated with a zero probability of default can be compared with the current level in order to assess "sustainability".

d) Implementation of "fan charts" (fan charts)

Essentially, this methodology uses statistical-econometric analysis tools to estimate the variance and correlation matrix of the shocks affecting the variables that influence the debt trajectory. Structural Vector Autoregressive Regression (SVAR) models are used to execute this procedure, incorporating projections of key macroeconomic variables (exogenous) with the purpose of tracing a stochastic medium and long-term path of public debt in terms of GDP.

The approach relies on the D/Y ratio dynamics equation:

$$d_t = \frac{(1+r_t)}{(1+g_t)} d_{t-1} - sp_t \quad (1)$$

where d_t is the debt to output ratio, r_t is the interest rate, g_t is the annual GDP growth rate, and sp_t is the balance of the primary balance of the public sector as a percentage of GDP.

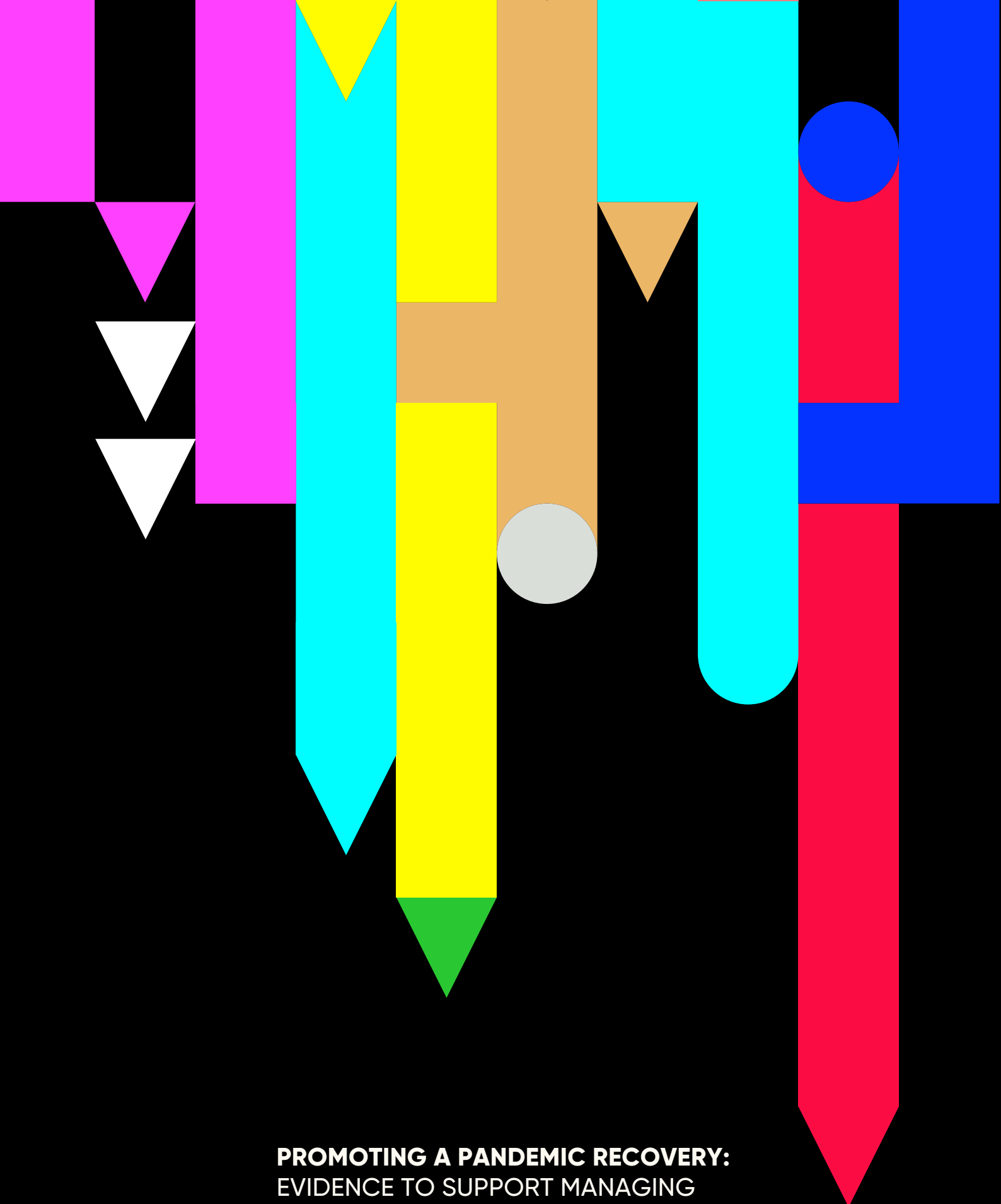
In order to draw a long-term stochastic path of public debt, projections of the variables that make up equation (1) must be incorporated, assuming that they have a stochastic evolution. In order to construct the confidence interval for the debt trajectories in the planning horizon considered this requires determining a probability distribution for each of them. In this context, a debt sustainability analysis using fan charts seeks to produce a simulated distribution of D/Y based on a dynamic that arises from a Vector Autoregressive (VAR) model from exogenous projections for the macroeconomic variables that integrate the right-hand side of equation (1), or by a combination of both techniques.

In more detail, the methodology in question follows the following sequence of steps defined by Arizala et al. (2010):

- define the debt dynamics equation (equation (1));
- select a time horizon T and the periodicity of the data (monthly, quarterly, annually) to estimate the VAR model and construct the required projections;
- collect data on the relevant variables;
- determine a procedure for projecting the exogenous variables involved in debt dynamics (it is usually most convenient to use the projections made by specialized government agencies or by the research departments of international organizations or agencies);

- simulations in order to obtain a range of possible results of dt for the defined planning horizon.

From this approach, it is also possible to assess the probability that the D/Y ratio will exceed, or at least come precariously close to, different debt "threshold" values, which are considered dangerous. Therefore, this type of methodology not only provides projected D/Y ratio values for a baseline scenario but also informs about the full distribution of likely D/Y ratio outcomes, incorporating the structure of random shocks impacting the economy.



PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING
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