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Adaptive fiscal policy for a hotter world

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Policy report

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Summary

Climate change is a persistent, systemic 'super shock'. To respond to this effectively, an adaptive fiscal policy needs to assume a structural, resilience-building mission alongside its traditional stabilisation role. Recurrent extreme events, structural climate damages and the upfront costs of mitigation and adaptation will place public finances under sustained pressure for decades. Thus, rigid, debt-anchored fiscal frameworks are now unfit for purpose.

The central argument of this report is simple: a temporary rise in public debt from front-loaded climate investment is not fiscal irresponsibility: it is the least risky strategy. Adaptive fiscal policy is a disciplined, transparent and forward-looking framework for managing the defining macroeconomic challenge of the 21st century. Without it, countries will face escalating disasters, weaker growth and sharply higher risk premia, leading to larger and more permanent debt burdens. With it, economies can secure lower future liabilities, stronger productivity and sustained increases in prosperity.

Evidence from academic and institutional sources is converging: failing to invest will raise fiscal costs by several percentage points (pp) of GDP, cause rising debt ratios through repeated shocks and amplify sovereign risk. By contrast, front-loaded, well-designed climate investment can raise potential output, reduce the volatility of fiscal shocks and lower sovereign risk over time — provided that markets can see how today's temporary 'green debt hump' will lead to a future decline in debt ratios and improve long-term debt sustainability.

Climate shocks differ from typical business-cycle disturbances. They are 'green swans': global, systemic and non-linear. Repeated disasters magnify each other's fiscal and economic costs, while transition risks reshape trade, investment and sovereign borrowing conditions. The challenge is therefore not merely stabilising annual budgets but redesigning fiscal architecture for a world of persistent structural shocks.

The central policy challenge is debt dynamics. Rising fiscal needs are colliding with high starting debt levels and tighter financial conditions. Rigid fiscal rules that target debt reduction mechanically are at risk of becoming procyclical. They will force governments to cut climate investments just when they are most needed, worsening long-term vulnerabilities. Instead, fiscal policy requires adaptive frameworks that explicitly recognise a temporary green debt hump: that is, a transitional rise in debt ratios during the investment phase of the 2020s and 2030s as governments front-load mitigation and adaptation.

The duration and scale of the hump depend on policy design: early, effective investment flattens and shortens it, while delayed action significantly extends and steepens debt trajectories through higher climate damages. Without such investment, debt sustainability deteriorates much more sharply due to repeated shocks, a lower level of growth and rising risk premia. A practical response is to extend the horizon over which debt rules operate, so that the requirement for debt to be falling does not inadvertently suppress long-term investment while still maintaining a time-bound commitment that reassures markets.

Historical experience from the First and Second World Wars shows that when needs are existential and time-critical, governments cannot raise taxes quickly enough; they rely on borrowing, coordinated planning and rapid industrial mobilisation, and then work debt down through growth, moderate inflation, primary surpluses and regulated funding costs. **The lesson to be learned is about sequencing, not command economics: front-loaded, investment-driven borrowing is less risky than under-investing and absorbing compounding losses.** Applied to climate, this argues for a temporary, well-signposted green debt hump within adaptive, state-contingent fiscal frameworks, paired with credible revenue paths and transparent communication to anchor market trust. Unlike war or pandemic-related debt, climate investment creates resilience and productivity, enhancing capital that materially improves future debt dynamics.

Climate policy also requires attention to political economy dynamics. Without adequate redistributive mechanisms, climate measures can disproportionately affect poorer countries, low-income households and vulnerable working- and middle-class groups, as well as specific sectors, depending

on how policies are designed. Carbon pricing without revenue recycling is typically regressive, risking social backlash and a vicious political economy loop that derails any more ambitious and effective climate policy.

To sustain support and protect the vulnerable, any credible package should hard-wire compensatory fiscal transfers (lump sum dividends or targeted rebates), **bolster affordable alternatives** (public transit, building retrofits, clean heating) **and communicate transparently** — particularly concerning who pays and who benefits. Embedding these elements transforms climate policy from a perceived burden into a fair transition strategy, strengthening the durability of the fiscal framework.

An adaptive fiscal framework can be operationalised through a coherent package of reforms, as summarised below. **With the right mix of policies, these features could stabilise — and in favourable cases lower — sovereign risk premia through several channels:**

- First, transparency and ring-fencing reduce uncertainty about cash flows and moral hazard, anchoring expectations for debt stabilisation after the hump.
- Second, verifiable use of proceeds and key performance indicators (KPIs) attract dedicated green investors, potentially tapping a structural 'greenium' and expanding the buyer base.
- Third, credit-enhancement overlays — guarantees from multilateral development banks (MDBs), catastrophe layers, public–private insurance — can be targeted to the ring-fenced green debt portfolio: namely, the part of the sovereign balance sheet dedicated to climate and resilience investment. Concentrating guarantees on this portfolio compresses tail risk and spreads it where it matters most.
- Fourth, methodological alignment, so that international financial institution (IFI) climate-adjusted debt sustainability analysis (DSA), fiscal council certifications and rating agency models explicitly recognise resilience payoffs and concessionality, reducing downgrade risk tied to short-term metrics that ignore avoided losses.

Proactive, transparent engagement with markets is crucial. Governments should adopt a 'no surprises' communications regime, publishing a climate–fiscal dashboard, disclosing a dated path for the green envelope cap and clarifying contingent triggers — for example, automatic tapering of the envelope as KPIs are met and step-up/step-down features in sustainability-linked instruments. Regular investor dialogues and joint briefings with fiscal councils and MDBs, together with standardised disclosure, will help anchor expectations that flexibility is rules-based, time-limited and reversible. Clear pre-commitment to revenue recycling (targeted transfers to protect low-income households) and to re-entering the medium-term anchor strengthens political economy support and market trust.

Long-term tax reform will also be essential to sustain fiscal space in a decarbonising economy. As emissions fall, traditional tax bases such as fuel excises and taxes on internal combustion engine (ICE) vehicles will erode. Governments will therefore need to shift towards more durable sources of revenue — for example, moving from ICE-based vehicle taxation to electric vehicle (EV)–appropriate road use and congestion charging, reforming electricity and energy-sector taxes, and gradually replacing carbon-linked revenues with broader and more stable tax bases. These structural reforms strengthen long-run fiscal sustainability and reduce reliance on debt.

The adaptive strategy proposed here rests on six operational pillars:

1. **Green versus legacy debt separation:** new debt accounting that distinguishes investment in mitigation and adaptation ('green debt') from pre-existing liabilities, governed by a green golden rule and credible repayment sequencing.
2. **Climate-adjusted debt sustainability:** reformed DSAs that feature longer-term horizons (around 20 years), use stochastic frameworks and explicitly incorporate climate shocks, green investment returns and state-contingent fiscal clauses.

3. **Risk-sharing mechanisms:** regional and global arrangements, MDB-backed guarantees, pooled issuance and insurance layers to transfer part of the climate risk away from sovereign balance sheets.

4. **Diversified financing strategies:** combining sovereign green bonds, debt-for-climate swaps, solidarity levies and upscaled domestic revenue reforms to secure predictable resources.

5. **Institutional and regulatory innovation:** independent budget evaluation offices, integration of fiscal–monetary coordination, updated credit rating methodologies and global green fiscal funds.

6. **Equity and credibility anchors:** redistributive transfers to protect vulnerable groups, transparent communication of fiscal rules and green debt envelopes, and proactive engagement with markets to manage risk premia.

The key is still market acceptance. Stabilising legacy debt through socially just and efficiency-oriented consolidation ensures that fiscal adjustment does not undermine equity or growth. Further, climate investment only becomes costly when it is discretionary, irregular or poorly communicated. Clear multi-year green budgets, credible investment pipelines and independently verified KPIs reduce this unpredictability premium, giving investors a transparent path.

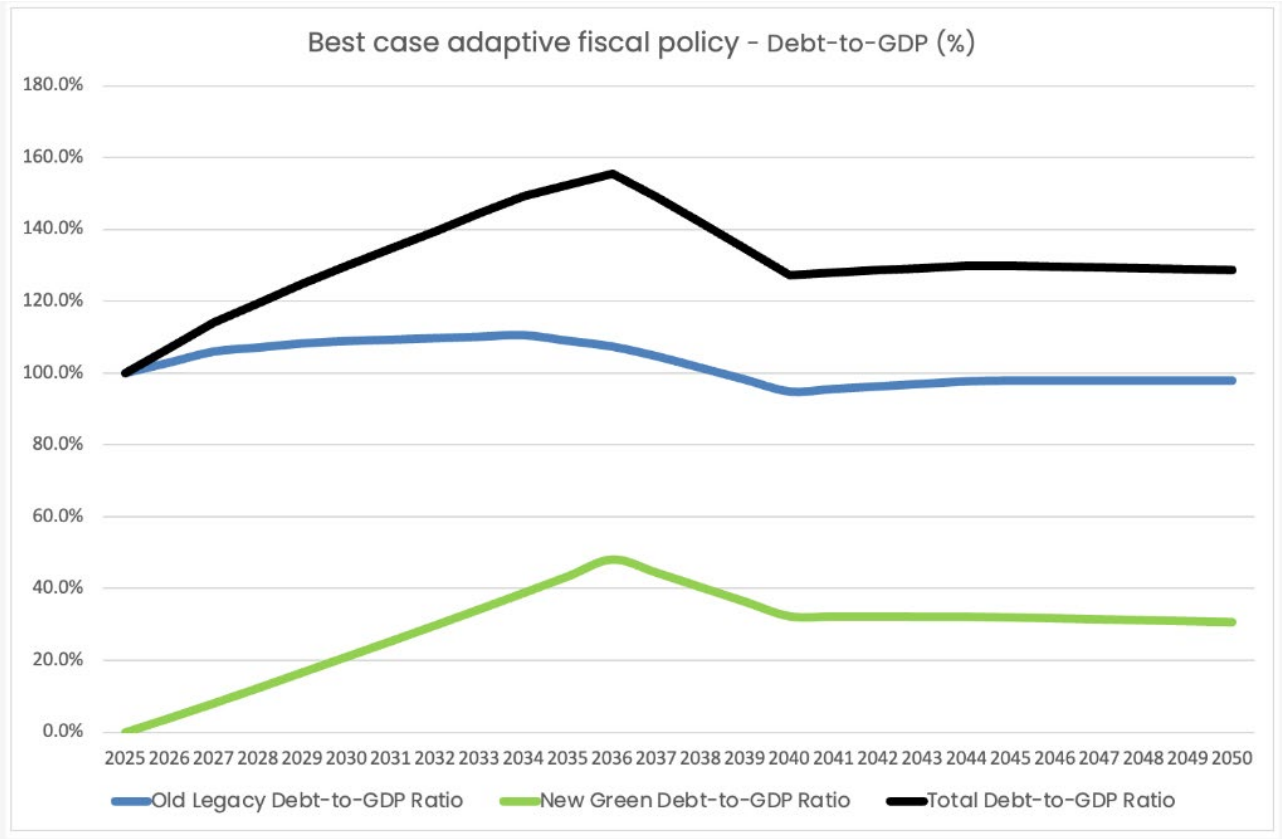
This adaptive strategy is not only necessary but fiscally feasible. The evidence suggests that mitigation and adaptation outlays of around 1–2% of GDP annually, plus redistributive transfers of 0.3–1.5% of GDP, are within the fiscal capacity of most economies — especially when combined with potential revenues of 2–4% of GDP from carbon pricing, subsidy reform and solidarity levies. Even with a temporary green debt hump, increasing debt ratios by around 30–40% of GDP over one or two decades (similar to what happened in the US and UK after the Second World War), introducing credible rules and transparent re-entry paths can stabilise or reduce sovereign risk premia, while the avoided damages from inaction, estimated at 7–12% of global GDP by the end of the century (and far higher in vulnerable economies), dwarf the upfront costs. In short, the fiscal arithmetic of the transition is sustainable: **predictable, time-bound investments now buy down exponentially larger liabilities tomorrow**.

Indeed, debt-dynamic simulations conducted for this report show that stabilising public debt in a climate-constrained world is feasible under an adaptive fiscal policy framework. If legacy debt is not consolidated or climate revenues fail to materialise, debt ratios will rise to unsustainable levels by 2050. By contrast, under the adaptive fiscal scenario — which combines socially just consolidation, realistic new climate revenues and the long-term growth and interest rate benefits of high-quality green investment — total debt stabilises after the temporary debt hump of the 2030s and then declines (see Figure S1). This shows that with credible, transparent and well-sequenced climate-aligned fiscal reforms, debt sustainability and ambitious climate action can reinforce rather than undermine each other.

These reforms do more than improve fiscal sustainability; they create a predictable fiscal architecture that reduces the information gaps and policy volatility investors struggle to price. When governments publish transparent green envelopes, dated re-entry paths and climate-adjusted debt trajectories, the transition will become a known quantity rather than a discretionary risk.

The adaptive fiscal framework rests on simple macroeconomic logic: because traditional taxation cannot stabilise both legacy and climate-related debt, a temporary and transparent green debt hump must be accepted as an intergenerational investment. This is made credible through a dual-account system that clearly separates legacy expenditure from productive green investment, giving markets predictable debt trajectories and strengthening confidence. The approach relies on realistic revenue mobilisation — especially climate-related taxation that is introduced progressively and fairly — while integrating evidence that greater climate resilience lowers sovereign risk premia and borrowing costs. Finally, the growth effects of well-designed climate investment reduce the interest–growth gap, making medium-term debt stabilisation achievable under plausible macroeconomic conditions.

Figure S1. Best case adaptive fiscal policy



Source: Author

In conclusion, adaptive fiscal policy for a hotter world requires fiscal frameworks to move beyond their traditional stabilisation role and the rigidity of debt anchors, and to adopt approaches that are both flexible and credible, and nationally grounded but internationally coordinated. By separating green from legacy debt, reforming debt sustainability assessments, sharing risks across borders and institutions, diversifying financing, innovating in fiscal governance, and embedding equity and transparency, countries can transform a temporary green debt hump into a catalyst for resilience, growth and fairness. The alternative — delayed action, fragmented responses and fiscal retrenchment — would lock in higher costs, weaker economies and greater instability. An adaptive fiscal framework offers the least risky path: borrowing today to invest in the transition that secures prosperity and stability tomorrow.

Part I. Diagnosis: Climate change and fiscal policy — impact, challenges and trade-offs

1. Introduction: fiscal policy in a hot and volatile world

Large, persistent and systemic macroeconomic supply and demand shocks from climate change are challenging the traditional fiscal policy framework. They complicate the trade-offs between stabilisation goals (short-term demand support) and structural and intertemporal reforms and constraints (long-term debt sustainability), and also affect monetary policy trade-offs (Barmes et al., 2024). An adaptive inflation targeting (adaptive-IT) framework has been proposed that updates today's predominantly inflation-targeting regimes to reflect this world of persistent, climate-driven supply shocks. Adaptive-IT gives central banks explicit, state-contingent flexibility targets and horizons, while strengthening analysis and communication.

The core idea is to preserve credibility on price stability but allow for greater patience when inflation is pushed up by sustained supply constraints, such as climate damages, energy shocks and fragmentation. Targets can be expressed as a range or with wider bands, or they can be slightly higher, with a longer policy horizon and forward-looking tools that embed climate and supply-side scenario analysis. The operational stance still tightens if second-round effects and de-anchoring risks emerge, but this framework reduces the bias towards procyclical tightening that would sacrifice output, financial stability, fiscal space and the green transition. Clear advance communication in calm times is essential, and the approach works best alongside coordinated fiscal measures that raise supply resilience, so monetary policy does not have to fight persistent cost shocks alone.

An adaptive fiscal framework applies the same state-contingent logic to public finances. It keeps a clear medium-term anchor for debt sustainability and credibility — hence low risk premia — while allowing flexible, rules-based space to navigate persistent climate and geopolitical shocks. Practically, it sets a transparent debt (or net-worth) path and primary-balance corridor over the cycle, but introduces climate-contingent clauses — automatic, time-bound room for higher deficits when disasters hit or when front-loading mitigation/adaptation is demonstrably growth-enhancing. To preserve market trust, it separates legacy versus green/resilience debt, applies a 'green golden rule' (capex with verified social/climate returns can be debt-financed within limits) and pre-commits offsetting revenue packages (progressive taxes, targeted carbon pricing with rebates) on a dated glidepath. An independent fiscal office runs climate-adjusted stochastic debt sustainability analysis (DSA) and scenario tests, triggers the clauses and certifies re-entry to the anchor as shocks abate. Risk-management tools (adaptation investments, public-private insurance schemes, catastrophe bonds, MDB guarantees/special purpose vehicles -SPVs) shift tail risks off the sovereign balance sheet, further containing premia. Regular, plain-language communications and data-rich reporting lock in accountability. The result is a framework that avoids procyclical austerity, safeguards investment in the transition and keeps sovereign risk low by coupling flexibility with hard, transparent commitments.

An adaptive fiscal framework may also require lengthening of the horizon of debt rules themselves. Many current frameworks, particularly in Europe, mandate that debt be falling within a five-year forecast window, which unintentionally biases policy towards cutting long-term climate investment. Extending the horizon to 8–10 years would better reflect the front-loaded nature of net-zero spending and allow its productivity and resilience benefits to appear within the forecast period rather than only in long-term scenarios. Formulating rules in this way shows markets that flexibility can be time-bound, predictable and compatible with fiscal discipline. Variants of this approach have already been implemented in the US.

The increasingly frequent manifestations of climate change are already exerting growing pressure for mitigation and adaptation spending, both domestically and globally. There are also social

consequences: climate transition imposes inequitable burdens on low-income groups, both households and countries, requiring redistributive compensation. Indeed, rising fiscal transition costs are compounded by more frequent materialisation of larger physical risks and pressing social demands. The result is rising, or at least sticky, primary deficits.

High debt levels and rising interest rates make this situation more challenging. Households are also experiencing sustained cost of living pressures, which heighten social vulnerability and constrain governments' capacity to enact long-term investment plans. Ageing societies, geopolitical fragmentation, defence spending pressures and the scale of climate mitigation and adaptation all point to higher baseline public outlays.

The hypothesis that public debt will rise is not a theoretical conjecture but an unfolding macro-fiscal trend. The fiscal and policy challenges of the climate transition are likely to be further exacerbated by the rise of nationalist populism and climate scepticism in several major economies, and the US in particular. These political dynamics risks are reversing hard-won climate policy commitments and reframing the policy agenda around short-term energy security and domestic fossil fuel exploitation as a driver of growth. In such contexts, climate mitigation and adaptation spending may be deprioritised in favour of subsidising carbon-intensive sectors, weakening carbon pricing frameworks and delaying structural reforms (Garcia-Macia et al., 2024). This shift not only undermines global emissions reduction trajectories, but also erodes investor confidence in the stability and credibility of national climate strategies, increasing the cost of capital for low-carbon investments and fragmenting international cooperation at precisely the moment when coordinated action is most needed.

Given growing global geopolitical fragmentation and security concerns, one scenario is that political economy pressure will tend to accommodate greater military expenditure while adopting a wait-and-see pause for climate-related spending for mitigation and adaptation. Worse, mounting fiscal pressures and shifting political priorities could lead not just to a pause, but to a reversal of climate policies, with governments dismantling or sharply reducing the scope of mitigation and adaptation programmes. In this case, fiscal frameworks could be reoriented towards short-term deficit reduction or other expenditure priorities, cutting most of the climate-related investments and subsidies currently in place.

Such retrenchment would likely halt progress towards net-zero targets, strand ongoing low-carbon infrastructure projects and discourage private sector participation by creating policy uncertainty. The cumulative effect would be to lock in higher emissions trajectories, increase long-term adaptation costs and reduce the resilience of economies to the physical and transition risks of climate change.

There is also a sociopolitical dimension to climate policies. Climate damages, and unrecycled carbon pricing, fall disproportionately on low-income households. Building on existing social discontent, these burdens risk triggering a backlash that could derail climate policy. There are ways to avert this — hard-wiring compensatory transfers (dividends or targeted rebates), expanding affordable alternatives (public transit, retrofits, clean heating) and communicating clearly who pays and who benefits, so the transition is perceived as fair and politically durable.

For financial markets, what often matters more than the level of public debt is the unpredictability of fiscal decision-making. Political cycles, fragmented climate commitments and abrupt policy reversals generate uncertainty that is difficult to price. This 'fiscal unpredictability premium' can dominate concerns about debt ratios themselves, especially when future policy paths are unclear. Climate policy adds another layer of uncertainty unless governments provide multi-year clarity on spending, financing and expected returns.

In any event, debt dynamics are becoming more complicated; with mounting climate-related risks, the textbook fiscal approach to higher debt using fiscal consolidation is not guaranteed to reduce risk premia and mitigate climate risk. It might lead to inaction, which is documented in the literature as triggering even higher fiscal costs in the future.

Governments — and Ministries of Finance in particular — must formally discuss adaptive fiscal policies for a hotter world:

1. Going beyond the stabilisation function, what fiscal role would there be for structural policies that are more investment-R&D-oriented (Schumpeterian-like public industrial policies), countercyclical, inclusive and resilience-focused?

2. What mix of traditional financing sources (taxation, debt) might be employed? What innovative financing sources can be considered (e.g. international taxation)?

3. What will the consequences of climate shocks be when inevitably they affect traditional debt sustainability conditions? Would financial markets allow some transitional flexibility if additional 'green' investments in the net-zero transition increase long-term potential output? How would the bond markets — which are often forward-looking and sensitive to risks around debt sustainability, inflation expectations and political commitment — react? Would they price in higher risk and volatility? Conversely, would they understand the need for new fiscal climate policies as risk-mitigating and regard them as sustainable?

Box 1.1. Fiscal categories in climate change economics

Three categories are essential for fiscal planning in climate change economics:

1. Damage costs
2. Adaptation costs
3. Transition (mitigation) costs

They correspond to the costs of inaction, reducing unavoidable damages and reducing emissions.

Damage costs (cost of inaction)

These represent the economic and fiscal losses from a hotter, more volatile climate: physical destruction, productivity losses, health costs and revenue erosion. Typically they are non-discretionary, volatile and potentially debt-creating, as they often require emergency spending. Evidence shows that the fiscal cost of damages can amount to >1% of GDP annually for large events, and cumulatively much more over time.

Adaptation costs (reducing damages that are unavoidable)

Their purpose is to reduce the damage from climate change that is already occurring or inevitable (e.g. flood defences, drought-resistant crops, resilient infrastructure). They consist of public investment and current spending, often non-discretionary after disasters, and are largely domestic, with mostly local and near- to medium-term benefits.

- Payoff: avoided losses, reduced reconstruction spending and protection of growth potential.
- Risk of delay: underinvestment increases future liabilities from disaster response, health impacts and infrastructure replacement.

Mitigation/transition costs (cost of action to reduce emissions)

Mitigation addresses the root cause of global warming by cutting greenhouse gas emissions (e.g. renewable energy, energy efficiency, carbon capture, reforestation). Transition costs represent the investments and policy measures needed to reach net-zero emissions — public spending, subsidies, infrastructure upgrades and retraining programmes. These costs are discretionary and plannable, with potential revenue offsets from carbon pricing or removal of fossil fuel subsidies. While politically sensitive, transition costs are generally lower and more predictable than the escalating, uncertain costs of inaction.

- Payoff: benefits are global, long-term and preventive, reducing the likelihood and severity of future climate damages.
- Risk of delay: locks in high-emission systems, making later action more expensive and increasing future adaptation needs.

There is complementarity between mitigation and adaptation: insufficient mitigation raises future adaptation costs; poor adaptation leaves societies vulnerable during the transition.

Fiscal policy implications

The choice is not between 'spend or save' but between paying predictable, manageable transition costs now or facing unpredictable, rising damage costs later, typically with higher debt and lower growth.

The report is structured as follows.

Section 2 argues that **climate change should be seen as a 'super shock'**, a 'green swan', rather than a typical cyclical disturbance: it is global, systemic and persistent, combining long-term trend shifts with acute extreme events. From the supply side, it functions as a major negative productivity shock, reducing labour efficiency, damaging capital and infrastructure, disrupting supply chains and imposing structural terms-of-trade losses on fossil fuel–dependent economies through global decarbonisation.

Section 3 highlights that **climate change poses major risks to growth, debt and fiscal stability.** It reduces long-term GDP, especially in low-income countries, while increasing the frequency and severity of disasters that strain public budgets. These impacts lead to higher debt levels, rising financing costs and downgraded credit ratings. At the same time, governments face growing spending needs for relief, adaptation and mitigation. Overall, the evidence shows that while climate action is costly, the fiscal and economic damage of inaction is far greater.

Section 4 explains that the **standard response to rising debt and fiscal pressures has been fiscal consolidation**. The rationale is that tighter budgets signal commitment to sustainability, reduce risk premia and help restore confidence in public finances. In some cases, consolidation is even viewed as being potentially expansionary through lowering borrowing costs and encouraging private investment.

Section 5 underscores the **magnitude of the fiscal consolidation pressures** created by climate change through the interaction of debt, growth and sovereign risk premia. As governments face higher spending needs but tighter financing conditions, a Catch-22 situation emerges: short-term prudence limits climate investment, which worsens long-term risks and increases premia. Simulations show that with debt at 100% of GDP, a baseline of 5% interest and 2% nominal growth only requires modest surpluses to stabilise debt. But when growth slows by 1–2 points and risk premia rise by 50–200 basis points, the required primary surpluses escalate sharply — demonstrating how easily debt dynamics can slip into a self-reinforcing spiral of higher costs, weaker growth and larger adjustment needs.

Section 6 sets out the **principles of an adaptive fiscal framework** to confront climate change. It argues that the vicious cycle of climate shocks, rigid austerity and rising social pressures should be broken while safeguarding fiscal credibility. A key pillar is separating legacy debt from new climate-related borrowing, so that investment in mitigation and adaptation is not crowded out by consolidation needs. This must be supported by risk-sharing through broader balance sheets (regional funds, MDBs), diversified revenue sources (domestic carbon taxes with redistribution, international solidarity levies) and institutional innovations at both the national and global levels — potentially including a national coordinator of climate policies (Ministry of Finance and/or planning) and a Global Climate Agency. Regulatory reforms should adapt prudential and accounting rules to reflect the growth-enhancing nature of climate investment, while social equity considerations, such as compensating vulnerable groups, are essential to preserve legitimacy and public support.

Section 7 develops the idea of **debt separation as a tool to preserve fiscal credibility** while financing the climate transition. Drawing on the precedent of Covid-19 responses, it argues for distinguishing

legacy debt, subject to gradual consolidation, from new green and resilience debt treated as productive investment. A dual accounting framework with parallel 'old' and 'green' budgets would enhance transparency, reassure markets and allow green borrowing to be credibly ringfenced. Sequencing is key: initial financing could rely on grants or guarantees from international institutions and coalitions, before shifting towards carbon revenues and climate levies. At the same time, legacy debt consolidation must be designed with social justice in mind, avoiding the contractionary and unequal effects of blunt austerity. Past episodes, such as Iceland post-2008 and Nordic consolidations, show that progressive taxation, targeted spending and phased strategies can restore balance while protecting vulnerable households and maintaining public support.

Section 8 explores **risk-sharing arrangements**, including regional budgetary mechanisms, MDB guarantees, pooled issuance and other innovations that shift climate risks off sovereign balance sheets.

Section 9 develops a **diversified and robust financing strategy**, combining domestic carbon taxation and subsidy reform with sovereign green bonds, debt-for-climate swaps and international solidarity levies, illustrated with a country case study (France).

Section 10 proposes **regulatory reforms**, especially changes to credit rating agency methodologies, alignment of DSAs with stochastic features, climate-adjusted metrics and harmonised treatment of sovereign climate investment to reduce procyclicality and crowd in private capital.

Section 11 focuses on **institutional innovation**, from independent budget evaluation offices through to stronger roles for finance ministries and fiscal–monetary coordination platforms, with an international layer through a Global Green Fiscal Fund.

Section 12 addresses the **redistributive dimension**, showing how well-designed transfers and compensation mechanisms are essential to offset regressive impacts, avoid backlash and sustain political legitimacy.

Section 13 explains that although adaptive fiscal frameworks rest on common principles, their practical **application must differ across countries** because fiscal space, institutions and market access vary widely. Countries should be mapped along six key criteria — income level, access to capital markets, exposure and natural endowments, technological capabilities, regulatory readiness and the scope for central bank or international support — to determine which adaptive fiscal instruments are appropriate and feasible in each context.

Section 14 turns to **market credibility**, explaining how adaptive frameworks can be communicated and anchored through transparency, earmarking, sequencing and credible re-entry paths, so that a temporary 'green debt hump' is seen as investment-driven and fiscally responsible rather than as fiscal drift.

The report concludes that climate change requires a paradigm shift in fiscal policy. An adaptive fiscal framework that balances flexibility with credibility, national measures with international coordination and investment with social justice offers the least risky strategy — borrowing today to build resilience, growth and fairness tomorrow.

Box 1.2. A primer on modern fiscal policy

Stabilising the economy through deliberate use of government spending and taxation dates primarily to the 1930s, with the rise of Keynesian economics. Over the past four decades, the role of fiscal policy has evolved beyond short-term stabilisation to address long-term challenges such as climate change, inequality and demographic shifts. This box outlines the main institutional features of modern fiscal frameworks.

Mandate

Fiscal policy serves multiple objectives: stabilising the business cycle, maintaining debt sustainability, supporting structural transformation (e.g. digital and green transitions) and reducing inequality.

Some of these objectives are codified in law through fiscal rules or public finance legislation, while others reflect evolving political and societal priorities. Unlike monetary policy, fiscal objectives are shaped by electoral mandates and political negotiation.

Institutional roles

Fiscal policy is conducted by the government, usually led by the Ministry of Finance, and approved by the legislature. Independent fiscal institutions such as fiscal councils or parliamentary budget offices have gained prominence as watchdogs, enhancing the credibility of macroeconomic forecasts and monitoring compliance with fiscal rules. Audit institutions assess the legality and efficiency of public spending.

Targets

Modern fiscal frameworks use a range of quantitative targets, such as structural budget balances, debt-to-GDP ratios and expenditure ceilings. In advanced setting, these frameworks might allow for flexibility to accommodate growth-enhancing or climate-related investments, with mechanisms such as investment clauses, golden rules, or green budgeting safeguards. Moreover, fiscal and climate-related targets are inherently political choices and therefore subject to frequent revision. This instability creates uncertainty for markets and makes long-term planning — essential for an effective transition — far more difficult.

Horizons

Fiscal policy operates on multiple time horizons. Annual budgets set short-term priorities. Medium-term expenditure frameworks (MTEFs) extend planning to three–five years, ensuring continuity and predictability. Long-term sustainability assessments, sometimes covering 20–30 years, are used to anticipate the fiscal implications of demographic change, climate policy and contingent liabilities.

Forecasts and models

Fiscal decisions rely on macroeconomic forecasts of growth, inflation and interest rates. These projections underpin revenue and expenditure estimates and guide debt management strategies. A key concern is debt sustainability, which depends on the relationship between growth and interest rates and the size of the primary fiscal balance (revenues minus non-interest spending). Sustained primary surpluses are generally needed to stabilise or reduce the debt ratio, especially when borrowing costs are high. Governments use baseline scenarios and stress tests to evaluate risks, including climate or financial shocks.

Budget processes

The annual budget law is the main legal instrument for implementing fiscal policy. The Ministry of Finance prepares the draft budget, outlining expected revenues, expenditures and borrowing needs. This draft is submitted to parliament, where it is debated, amended and ultimately approved. Budget execution is monitored throughout the fiscal year and adjustments may be made through supplementary budgets.

Political process and parliamentary oversight

Fiscal policy is inherently political. Once the draft budget is submitted, it is examined by specialised parliamentary committees, such as those for finance, budgets, or public accounts. These committees may hold public hearings and request expert input. Parliamentary debate allows elected representatives to scrutinise policy choices, propose amendments and ensure alignment with national priorities. While the executive typically initiates the budget, parliamentary approval is required to give it legal force. Some systems limit parliament's ability to increase spending or reduce revenues unless compensatory measures are proposed. Mid-year revisions and emergency spending measures are also subject to parliamentary procedures, preserving democratic oversight.

Accountability

Fiscal accountability is exercised through multiple channels: legislative approval and oversight, public reporting, independent fiscal institutions that can project their own estimates of public

finance aggregates and audit bodies. These mechanisms aim to prevent misreporting, ensure transparency and maintain public trust. Increasingly, governments also engage the public through citizen's budgets and social impact assessments.

Communication

Transparent communication of fiscal plans and risks is essential for credibility. Most governments publish budget documentation, fiscal risk statements and long-term projections. Pre- and post-budget reports explain macroeconomic assumptions and policy rationales. In some countries, fiscal documents also include green budgeting tags and equity impact statements to improve the visibility of social and environmental objectives.

2. What kind of a shock is climate change?

From a macroeconomic perspective, climate change is not a single, discrete shock but a complex, multi-dimensional shock that operates through both supply and demand channels, with features that distinguish it from typical business-cycle disturbances. It combines permanent, trend-altering components with acute, high-intensity events. This dual nature makes it closer to a super shock; one that is persistent, global and systemic.

2.1. Climate change as a green swan

On the supply side, climate change acts primarily as a negative productivity shock, a persistent large negative supply shock — it reduces productive capacity via destruction of infrastructure, labour and ecosystems. Rising average temperatures and more frequent heatwaves, droughts and floods reduce labour productivity, especially in sectors such as agriculture, construction and manufacturing, which are exposed to outdoor conditions. Extreme events destroy capital stock (infrastructure, housing, productive equipment), lower total factor productivity and disrupt supply chains. For fossil fuel–dependent economies, global decarbonisation policies introduce a structural terms-of-trade shock by reducing demand for carbon-intensive exports.

On the demand side, the picture is more nuanced. Climate change also generates secondary demand shocks through income loss, displacement and uncertainty — though these are often offset by emergency spending. Disasters can cause short-term boosts to investment during reconstruction, but they also depress consumption through income losses, heightened uncertainty and tighter credit conditions. As extreme events become more frequent, overlapping and compounding, countries will increasingly lose the ability to benefit from the temporary boosts in reconstruction-related investment, as fiscal and administrative capacity are continuously eroded by repeated recovery cycles. Climate mitigation policies, depending on their design, can shift demand composition — reducing spending on fossil fuels and increasing spending on green capital — and influence intertemporal choices through carbon pricing. In some cases, poorly sequenced transitions can create contractionary effects, akin to an energy price shock.

Climate change also has a financial stability dimension that standard macro shocks lack. Physical risks (damage to assets, stranded capital) and transition risks (revaluation of carbon-intensive assets, sudden policy shifts) can propagate through balance sheets, leading to credit contractions, higher sovereign risk premia and capital flow volatility, especially in emerging markets. These mechanisms create non-linearities: the macro impact of climate shocks grows disproportionately with severity, and repeated shocks can erode fiscal and monetary policy space.

Perhaps most importantly, **climate change is a global, very large and correlated shock**. Unlike idiosyncratic weather events, the gradual warming trend and the rising frequency of extreme events are felt across multiple economies simultaneously, reducing the scope for diversifying risk through trade or capital flows. Moreover, spillovers from one region quickly affect others — through migration, commodity price spikes, or financial contagion — turning local climate impacts into global macroeconomic disturbances. Transition dynamics may involve positive demand shocks (e.g. due to reconstruction, infrastructure, etc.) but disorderly transitions (e.g. sudden carbon pricing) can mimic 'stagflationary' supply shocks.

In summary, climate change is best understood as a persistent, structural, very large supply shock with demand, financial and geopolitical spillovers. It differs from typical macro shocks in its permanence, global reach and interconnection with other systemic risks. This classification has implications for policy: conventional countercyclical tools are insufficient on their own; macroeconomic frameworks must integrate climate considerations into long-term growth, fiscal sustainability and financial stability strategies. In a nutshell, climate shocks are non-linear, systemic and global (green swans). They differ from typical cyclical disturbances and demand adaptive policy responses.

Box 2.1. The green swan

The term 'green swan' was introduced in a report by a group of economists and central bankers gathered at the Bank for International Settlements (BIS) — *The Green Swan: Central Banking and Financial Stability in the Age of Climate Change* (Bolton et al., 2020). It was inspired by the concept of the 'black swan' popularised by Nassim Nicholas Taleb (2007), referring to rare, unpredictable events with systemic consequences.

In contrast, green swans are certain. Major climate shocks such as the melting of ice sheets, massive deforestation, extreme heatwaves and devastating floods will inevitably occur in the coming decades if no climate policy action is taken. While their exact timing, frequency and intensity are uncertain, their potentially destabilising effects on economies and financial systems are already well established.

For central banks and regulators, this notion requires a paradigm shift: the task is no longer only to react to unexpected crises but to anticipate inevitable climate shocks that are difficult to model. This implies developing forward-looking scenarios, strengthening climate stress tests and explicitly integrating physical and transition risks into financial stability surveillance. In other words, to acknowledge the existence of green swans is to recognise that climate has become a key determinant of macroeconomic and financial stability and, as such, has a direct impact on the ability of central banks to fulfil their mandates. It therefore entails an obligation to act.

For Ministers of Finance, the recognition of green swans has equally profound implications. Climate shocks translate directly into fiscal pressures through rising disaster relief and adaptation expenditures, erosion of tax bases and the accumulation of contingent liabilities. Transition dynamics also reshape revenues; while carbon pricing and subsidy reform can generate fiscal space, poorly managed policies risk undermining growth and widening deficits. Ministers of Finance must therefore integrate climate scenarios into debt sustainability analysis, budget frameworks and medium-term expenditure plans to prevent green swans from destabilising public finances.

Table 2.1. Black swans versus green swans

Feature	Black swan	Green swan
Frequency	Extremely rare	Increasingly frequent (heatwaves, floods, droughts)
Systemic impact	Potentially systemic	Inevitably systemic and global
Policy implication — central banks	Focus on resilience and crisis management	Anticipation, scenario analysis, stress testing, proactive intervention
Policy implications — Ministries of Finance	Occasional fiscal shocks	Permanent expenditure pressures, revenue shifts, higher debt risks; require climate-informed fiscal frameworks
Relevance for macro policy	Exogenous, episodic	Structural, persistent, macro-critical

2.2. Climate change shocks are different from the usual macroeconomic shocks

Table 2.2 contrasts climate change shocks with business-cycle disturbances, supply shocks and financial crises. While typical shocks are sharp but temporary, climate change combines permanent, trend-altering effects with acute high-intensity events, making it a systemic super shock. It operates primarily as a persistent negative supply shock, but also generates demand shifts, financial stability risks and global spillovers (Gagliardi et al., 2022). Unlike cyclical shocks that can be countered with conventional tools, climate change requires integrated macroeconomic, fiscal and prudential responses to address its long-lasting and global nature.

Table 2.2. Climate change compared to other macroeconomic shocks

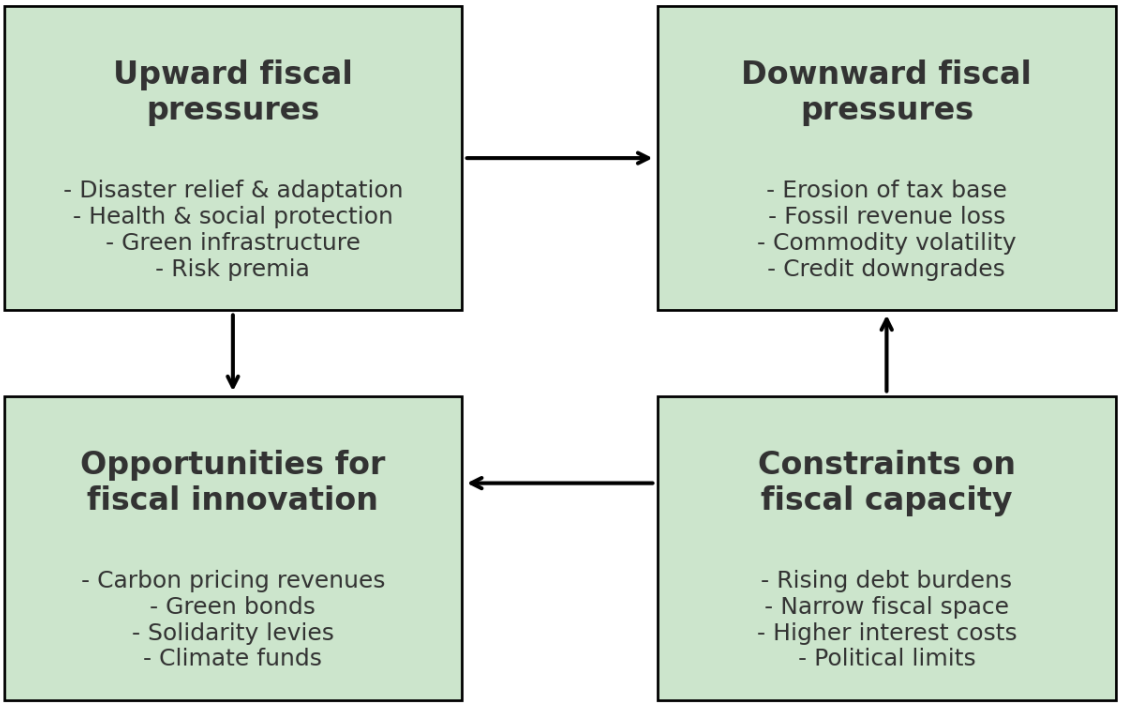
Dimension	Business-cycle shock (e.g. demand slump)	Standard supply shock (e.g. oil shock)	Financial crisis shock (e.g. 2008 global financial crisis)	Climate change shock
Nature and duration	Temporary, cyclical	Often sharp but temporary	Sharp, can have medium-term scars	Persistent, trend-altering, permanent
Scope	National or regional	Global if commodity related	Global via financial contagion	Global, correlated, systemic
Supply side	Idle capacity, unemployment	Input cost increase, reduced output	Credit crunch lowers investment	Large negative productivity shock: lower labour productivity, capital destruction, ecosystem loss, supply chain disruptions
Demand side	Reduced consumption/investment	Contraction via higher prices	Wealth effects, uncertainty, deleveraging	Mixed: income loss and uncertainty depress demand; reconstruction and green investment raise demand; carbon pricing reshapes demand composition
Financial stability dimension	Limited, direct	Indirect via inflation/interest rates	Core mechanism: banking, credit collapse	Direct: stranded assets, revaluation of carbon-intensive capital, rising risk premia, capital flow volatility
Non-linearity	Mild, self-correcting	Can be stagflationary but contained	Sharp, with hysteresis	Strongly non-linear: repeated and severe events amplify losses, policy space erodes
Global spillovers	Trade spillovers, limited	Commodity price pass-through	Financial contagion	Migration, commodity shocks, cross-border disasters, financial contagion — global amplification
Policy space	Countercyclical fiscal/monetary tools effective	Policy trade-offs (inflation versus growth)	Large stimulus and bailouts needed	Conventional tools insufficient; requires integrated fiscal, monetary, and prudential frameworks
Classification	Temporary demand shock	Temporary supply shock	Financial shock with real spillovers	Super shock: persistent, structural, global, systemic

Rethinking macroeconomic policy for a climate super shock

The analysis above makes clear that climate change cannot be treated as a standard, cyclical disturbance. Unlike conventional supply shocks or demand recessions, oil shocks, or even financial crises, climate change is a super shock: permanent, systemic and global. It combines persistent negative supply effects with shifting demand patterns, financial instability risks and cross-border spillovers. Its impacts are non-linear, cumulative and difficult to diversify away.

Figure 2.1 presents a four-dimensional framework for the fiscal challenges posed by climate change. First, there are upward fiscal pressures from new spending needs for mitigation and adaptation. Second, downward fiscal pressures follow from the erosion of revenues. These two forces together generate constraints on fiscal capacity through higher debt, rising interest costs and political limitations. These constraints hamper the scope for fiscal innovation, such as carbon pricing, green bonds, or solidarity levies, which could otherwise provide part of the solution. The arrows show the cycle: pressures and constraints reinforce one another, while innovation offers partial relief but remains limited by the available fiscal space.

Figure 2.1. Four-dimensional framework for fiscal challenges from climate change



Source: Author

New expenditures related to climate policy are listed below.

New mitigation expenditures

Mitigation policies require sustained public leadership and risk-sharing with the private sector. Core components include:

- Public–private expansion of green technologies: co-investment to accelerate the deployment of renewable energy, energy efficiency initiatives and sustainable mobility solutions.
- Net zero transition fund: a long-term national investment vehicle dedicated to financing the structural shift to a decarbonised economy, including industrial reconversion and workforce retraining.
- R&D for emissions reduction and carbon capture: strategic funding for breakthrough technologies in carbon sequestration, storage and industrial decarbonisation processes.

- **International mitigation contributions to developing countries**: predictable fiscal transfers to global climate funds supporting mitigation in lower-income countries, aligned with fair-share principles based on past and present emissions.

New adaptation expenditures

Adaptation investments are critical to reduce the long-term economic and social costs of climate change. Key areas include:

- **Disaster Relief Fund**: a permanent, well-capitalised fund to finance rapid responses to climate-related disasters, avoiding disruptive ad hoc budget reallocations.
- **Public participation in climate insurance**: fiscal co-financing of public–private insurance schemes to expand coverage, reduce premia and complement private market capacity in high-risk areas.
- **Resilience investment partnerships**: large-scale infrastructure and community resilience projects, co-financed by public funds, private capital and MDBs.
- **R&D on resilience technologies**: dedicated funding for innovation in resilient materials, climate monitoring and disaster forecasting systems.

These features imply that traditional countercyclical tools such as short-term fiscal stimulus, temporary monetary accommodation and targeted financial backstops are insufficient on their own. Standard policy frameworks were designed for smaller, temporary and reversible shocks that self-correct or fade over time; climate shocks, by contrast, alter long-term growth paths, erode productive capacity and repeatedly test the limits of fiscal and monetary space.

A new policy architecture is therefore required. It must integrate long-term climate considerations into macroeconomic frameworks, combining adaptive fiscal rules, green investment strategies, forward-looking monetary regimes and climate-sensitive financial regulation. It must also account for the distributional consequences of both physical impacts and transition policies, ensuring social protection and political legitimacy. Above all, policy must be preventive as well as reactive: building resilience, steering investment and reducing systemic vulnerabilities rather than simply mitigating cyclical downturns.

In sum, climate change demands a rethinking of macroeconomic policy along structural, prudential and intertemporal lines. Treating it as a persistent supply shock with systemic financial and global dimensions means abandoning the illusion that business-as-usual instruments suffice. The task ahead is to design adaptive macro frameworks that preserve stability while enabling the deep transformation required for a sustainable and just transition. Before that, we shall examine the evidence about the fiscal impact of climate change.

3. How climate change affects growth, debt and fiscal balances

3.1. Climate change as a source of large, persistent fiscal pressures: evidence from the academic literature

The literature indicates that climate change will bring significant expenditure pressures for disaster relief, mitigation, adaptation infrastructure and health costs, while increasing public debt vulnerabilities, sovereign risk premia and downgrade risks (Fuje et al., 2023; Acevedo et al., 2020; Barrage, 2024; Bilal and Känzig, 2024; Jones, Keen and Strand, 2012). The recent literature confirms that climate change is macro-critical and fiscally destabilising, especially for emerging markets and developing economies (EMDEs) (see Table 3.1). These arguments are also consistent with the Independent High-Level Expert Group on Climate Finance (IIHLEG), which concludes that a substantial *investment push* is now unavoidable if countries are to meet development and climate goals while managing escalating physical risks (Bhattacharya et al., 2025).

A growing body of research has established clear links between climate change and long-term GDP growth (Shirley and Swanson, 2025). Early work by Nordhaus (1991) emphasised that unchecked

warming could reduce global output by 1–4% under a doubling of CO_2. The Stern Review (2007) argued that business-as-usual emissions could result in GDP losses of up to 20% compared to mitigation costs of about 1% of GDP annually.

More recent studies sharpen these estimates. Burke, Hsiang and Miguel (2015) showed that rising temperatures could reduce global GDP by as much as 23% by 2100, with particularly severe income losses for low-income countries. Bilal and Känzig (2024) similarly found that each additional degree of warming lowers GDP by 1.4–3%, with cumulative losses reaching 20% by the end of the century. Caruso et al. (2024) extended this perspective by documenting how climate shocks affect human capital, implying long-term GDP losses.

Extreme events compound these effects. Acevedo, et al. (2020) estimate that severe climate shocks in Latin America reduce GDP by 1–2% in the short run and increase debt ratios by 5–10% within five years. Together, this literature confirms that climate change not only erodes current economic performance, but also undermines the foundations of long-term growth through damage to productivity, human capital and fiscal sustainability (Carlin and Arshad, 2022). These estimates are widely considered to be conservative, as most models do not incorporate climate tipping points, non-linear damage functions, or cascading system interactions, all of which could lead to substantially larger losses.

These growth impacts translate into direct fiscal costs through damages, mitigation spending and adaptation programmes. The Stern Review (2007) highlighted that avoiding the worst damages would require mitigation expenditures of around 1% of GDP annually, a far lower figure than the potential output losses of inaction. Burke, Alampay and Diffenbaugh (2018) reinforced this point by showing that adherence to the Paris Agreement targets could avert GDP losses of about 20% by 2100, even if mitigation costs reach 1–2% of GDP per year.

Studies of natural disasters confirm the fiscal burden. Acevedo et al. (2020) document how repeated climate shocks in Latin America strain public budgets, with adaptation and disaster response costs averaging 0.5–1.5% of GDP annually. In a more recent work, Black et al. (2024) emphasise the fiscal duality of the transition, showing that while carbon pricing can raise significant revenues, the persistence of fossil fuel subsidies continues to erode fiscal space. Together, these studies demonstrate that climate change imposes sizeable fiscal costs through both unmitigated damages and the necessary expenditures for mitigation and adaptation, with the balance depending on the timing and design of policy interventions (see also Tol (2023), who finds that Paris Agreement-compatible mitigation pathways require carbon tax revenues of roughly 7% of GDP and subsidies for sequestration of around 6.6% of GDP).

Beyond these direct costs, climate change also exerts indirect fiscal effects through its impact on revenues, debt service and contingent liabilities. Burke et al. (2015) and Bilal and Känzig (2024) highlight how large output losses — of up to 20% of GDP by 2100 in severe scenarios — translate into diminished revenues and narrower fiscal space. Acevedo et al. (2020) further demonstrate that repeated climate shocks not only depress GDP but also widen fiscal deficits and increase debt ratios by 5–10% of GDP within five years, raising debt service burdens.

These findings underscore that climate change weakens fiscal sustainability not only through visible spending and damage costs, but also via subtler channels that erode revenues, compound debt pressures and expose governments to unpredictable contingent risks (Barrage, 2020, 2024; Catalano, Forni and Pezzolla, 2020).

Taken together, these effects have significant implications for public debt sustainability. Nordhaus (1991) and Stern (2007) emphasised that without timely mitigation, climate damages would push economies onto lower growth trajectories, worsening the dynamics of debt relative to GDP. More recent studies confirm this risk. Acevedo et al. (2020) find that climate shocks in Latin America raise public debt ratios by 5–10% of GDP within just a few years, illustrating how repeated disasters can set countries onto unsustainable fiscal paths. Bilal and Känzig (2024) find that warming-induced output losses could lift debt-to-GDP ratios by over 1% annually, accumulating to major increases by 2050. Burke, Hsiang and Miguel (2015) further underscore the scale of the challenge, with GDP losses approaching one-quarter of global output by 2100, which would severely erode debt sustainability.

In sum, the academic literature leaves little doubt that climate change is macro-critical and fiscally destabilising. Recent work is sharpening this understanding. Rising et al. (forthcoming) synthesise nearly 300 studies and over 6,000 estimates and show that, by 2050, climate change could reduce GDP per capita for the average person by around 8%, based only on temperature shocks and sea-level rise, with welfare losses projected at around 14%. The impacts are highly unequal: low- and lower-middle-income countries are projected to face losses exceeding 20% of GDP per capita in some cases, and the least developed countries are already an estimated 10% poorer in GDP per capita terms due to climate change. Climate impacts also depress labour productivity, increase unemployment and inequality, and create persistent upward pressure on inflation, with knock-on effects for debt dynamics and monetary–fiscal interactions.

From a fiscal perspective, this implies rising demands on public budgets through higher spending needs and lower revenues, alongside mounting risks to sovereign credit ratings and borrowing costs as climate impacts materialise. Rising et al. (forthcoming) highlight the risk of a vicious cycle: climate shocks weaken growth and fiscal positions, which in turn increase financing costs and undermine the capacity of vulnerable countries to invest in adaptation and other development priorities. This strengthens the case for treating adaptation as a core element of prudent macro-fiscal management rather than as a discretionary add-on.

Overall, the literature converges on a simple conclusion: the fiscal cost of early and balanced climate action is significant but manageable, while the fiscal cost of inaction is far higher, both in direct damage to public finances and in long-term growth losses. The fiscal impacts of climate policies depend heavily on the timing, sequencing and mix of policy instruments implemented, as well as country-specific exposure to physical risks and energy dependence.

Table 3.1. Climate change impacts from selected recent academic literature					
Author	Title and year	Growth impact	Fiscal revenues (% GDP/monetary)	Fiscal expenditures (% GDP/monetary)	Debt-to-GDP impact (% GDP)
Black et al.	*Fiscal Implications of Global Decarbonization* (2024)	—	Carbon pricing revenues mentioned; fossil fuel subsidies mentioned	—	—
Bilal and Känzig	*The Macroeconomic Impact of Climate Change* (2024)	GDP losses of up to 20% by 2100; 1.4–3% of GDP per °C; 0.05–1.5% annually in moderate cases	Carbon pricing revenues mentioned; fossil fuel subsidies mentioned	Expenditures of up to US$12 trillion globally; ~US$6.4 billion at country level	Debt increase of ~1.2% of GDP by 2050
Caruso et al.	Climate changes affect human capital (2024)	Persistent temperature shocks reduce human capital	—	—	—
Burke, Hsiang, Miguel	Global non-linear effect of temperature on economic production (2015)	Global GDP losses of ~23% by 2100; low-income countries lose 75% of income versus baseline	—	Adaptation expenditures implied	—
Acevedo et al.	The effects of weather shocks on economic activity: what are the channels of impact? (2020)	GDP losses of 1–2% per severe event	—	Adaptation/disaster costs of 0.5–1.5% of GDP annually	Public debt rises by 5–10% of GDP within five years
Burke, Alampay, Diffenbaugh	Large potential reduction in economic damages under UN mitigation targets (2018)	Avoided GDP losses of 20% by 2100 under Paris targets	—	Mitigation costs of 1–2% of GDP annually	—
Dell, Jones, Olken	Temperature shocks and economic growth (2012)	-1.3% growth per °C in low-income countries	—	—	—

Source: Author's review

3.2. Climate change as a source of large, persistent fiscal pressures: evidence from institutional reports

Institutional reports broadly confirm the academic findings that climate risks and transition costs will permanently raise fiscal stress and demands, a dynamic some analysts describe as a "great fiscal reversal". Abalo et al. (2025) project GDP losses exceeding 10% in vulnerable economies by mid-century, with adaptation spending needs equivalent to several points of GDP annually. The Network for Greening the Financial System (NGFS) (2022) scenarios similarly show disorderly transitions cutting global GDP by 3% by 2050 and raising fiscal pressures as late action forces higher investment and compensation costs. Meanwhile, the International Monetary Fund (IMF) (Fuje et al., 2023) estimates fossil fuel subsidies at over 7% of global GDP, underlining how entrenched fiscal structures exacerbate vulnerabilities and crowd out climate investment. Taken together, these reports underscore that climate change will not only weigh persistently on growth but also destabilise fiscal balances and amplify debt sustainability risks across advanced and emerging economies alike.

Reports highlight both expenditure pressures and shifts in revenues on the fiscal side. The IMF estimates that, on top of a need to invest almost 8% of GDP annually on average to achieve the United Nations' (UN's) Sustainable Development Goals between 2021 and 2030 — many of which will help build countries' resilience against climate change — an additional investment of 0.7% of GDP will be required for climate adaptation (IMF, 2020, 2023). Abalo et al. (2025) likewise shows that adaptation investments can offset part of the long-run GDP losses but require front-loaded spending commitments equivalent to several points of GDP in vulnerable economies.

At the same time, mitigation policies reshape the revenue base. The NGFS (2022) notes that carbon pricing and emissions trading schemes can provide stable fiscal inflows, while the IMF (2023) quantifies the potential revenue from full fossil fuel price reform at 3.6% of global GDP, compared to subsidies that still absorb over 7%. The OECD (2021) echoes this duality, emphasising that well-designed fiscal frameworks can reallocate resources from subsidy reform and carbon pricing to fund adaptation and mitigation expenditures. Together, these reports underline that climate change transforms the structure of public finances, increasing expenditure demands while simultaneously offering new avenues for sustainable revenues.

Public debt trajectories reflect the interaction of these forces. Institutional reports converge on the view that climate change and the transition will exert lasting upward pressure. The *Fiscal Monitor 2023* (IMF, 2023) shows that relying solely on spending-led strategies could push debt ratios up by 45–50% of GDP by 2050, while even balanced policy packages combining carbon pricing and investment would still raise debt by 10–15% of GDP. The NGFS (2022) scenarios highlight that delayed action not only deepens GDP losses but also forces higher financing needs, compounding debt sustainability risks. More broadly, the IMF (2023) underscores that entrenched fossil fuel subsidies — currently over 7% of global GDP — represent a structural drag on fiscal space and will exacerbate vulnerabilities if they are not reformed.

Taken together, these findings suggest that climate change has the potential to fundamentally alter debt dynamics, with risks of persistent upward drift in debt-to-GDP ratios absent timely mitigation and adaptation policies. The NGFS (2024) shows how delayed transitions magnify fiscal vulnerabilities: disasters and policy stagnation could wipe out 12.5% of Africa's GDP, compounding sovereign risk. Finally, the BIS (2020) cautions that climate change introduces systemic financial risks that undermine sovereign debt sustainability in ways that traditional debt sustainability analyses are not equipped to capture.

Institutional assessments find that, on average, climate change could lower global GDP by around 1–4% by 2050, with losses rising to well above 10% in vulnerable economies and by up to 20% in severe scenarios. Fiscal deficits widen structurally as adaptation and disaster-related expenditures average 1–2% of GDP annually, with major events producing spikes that are several times higher, while fossil fuel subsidies still absorb more than 7% of global GDP. Public debt trajectories point upward, with spending-led strategies adding 45–50% of GDP by 2050, and even when balanced with carbon pricing and investment the increase remains around 10–15% of GDP. Overall, these averages confirm that climate change exerts persistent downward pressure on growth, structurally higher fiscal deficits and rising debt vulnerabilities.

Table 3.2. Climate change impacts from selected recent official reports					
Institution	Title and year	Growth impact	Fiscal revenues (%GDP/monetary)	Fiscal expenditures (%GDP/monetary)	Debt-to-GDP impact (%GDP)
IMF	*Fiscal Monitor — October 2023* (2023)	Simulation-based GDP impacts: -0.5% to 0%; empirical estimates: 0 to +0.5%	Carbon pricing revenues mentioned	—	Debt increase of +10–15% of GDP by 2050 (balanced package); +45–50% by 2050 (spending only)
IMF	*Fiscal Monitor — October 2020* (2020)	—	—	Adaptation needs: US$25 billion annually (~1.1% of GDP in low-income countries)	—
World Bank (produced by Abalo et al., 2025)	*The Macroeconomic Implications of Climate Change Impacts and Adaptation Options* (2025)	GDP losses exceeding 10% by 2050 in vulnerable countries	—	Adaptation measures can offset losses (0.3–15% GDP gains)	—
NGFS	*Scenarios for Central Banks and Supervisors* (2022)	GDP impact of -3% by 2050 under disorderly transition; higher damages without mitigation	Carbon pricing revenues mentioned	Transition costs of 1–2% of GDP annually	Debt pressures higher by 2050 under late action
IMF	*IMF Fossil Fuel Subsidies Data* (2023)	—	Fossil fuel subsidies: US$7 trillion (~7.1% of global GDP); revenue potential of 3.6% of GDP from full price reform	Subsidies equivalent to 7% of global GDP (fiscal expenditure)	—
IMF (produced by Garcia-Macia, Lam and Nguyen, 2024)	*Public Debt Dynamics During the Climate Transition* (2024)	—	US$270 billion in subsidies under the Inflation Reduction Act (IRA) (illustrative)	Green subsidies of 0.2–2% of GDP annually	+45–50% of GDP by 2050 with spending only; +10–15% with balanced package

Source: Author's review

In general, both academic and institutional analyses converge on the conclusion that climate change is macro-critical and fiscally destabilising, although they differ in their scope and emphasis. Academic studies quantify the long-term growth impacts, estimating that each degree of warming reduces global GDP by about 1–2%, with cumulative losses of up to 20% of GDP by 2100 in severe scenarios. They also highlight direct fiscal costs: natural disasters typically call for expenditures of 0.5–2% of GDP per event, recurrent adaptation needs add 1–2% annually and mitigation efforts require 1–2% per year; well below the damages avoided.

Debt vulnerabilities emerge quickly, with repeated shocks adding 5–10% of GDP within a few years and persistent warming contributing over 1% annually. Institutional assessments, by contrast, emphasise nearer-term fiscal and debt trajectories: global GDP could fall by 1–4% by 2050, with losses exceeding 10% in vulnerable economies. Fiscal balances deteriorate structurally as adaptation and disaster expenditures average 1–2% of GDP annually, compounded by fossil fuel subsidies still exceeding 7% of global GDP.

Debt paths show steeper risks, with spending-only strategies adding 45–50% of GDP by 2050, and even balanced packages increasing debt by 10–15%. Taken together, these perspectives confirm that climate change narrows fiscal space, heightens deficits and creates mounting debt vulnerabilities, particularly in EMDEs.

Table 3.3. Academic versus institutional assessments of climate impacts

Dimension	Academic literature (averages)	Institutional assessments (averages)
GDP growth impact	1ºC warming reduces global GDP by 1–2%; cumulative losses of up to 20% of GDP by 2100 in severe scenarios	Global GDP down 1–4% by 2050; losses above 10% in vulnerable economies — up to 20% in severe scenarios
Fiscal expenditures	Natural disasters cost 0.5–2% of GDP per event; recurrent adaptation and disaster spending of 1–2% of GDP annually; mitigation costs of 1–2% of GDP annually (below damages avoided)	Adaptation and disaster spending of 1–2% of GDP annually, spikes much higher after major events; fossil fuel subsidies absorb >7% of global GDP
Fiscal revenues	Limited evidence but some studies highlight potential from carbon pricing and risks from subsidy persistence	Carbon pricing and subsidy reform identified as key revenue tools; potential for 3–4% of GDP globally from full price reform
Public debt impact	Climate shocks increase debt by 5–10% of GDP within a few years; persistent warming adds >1% of GDP annually, leading to unsustainable levels by mid-century	Debt rises by 45–50% of GDP by 2050 in spending-only strategies; increase of 10–15% of GDP with balanced carbon pricing and investment
Overall conclusion	Climate change is macro-critical and fiscally destabilising, narrowing fiscal space and heightening debt vulnerabilities	Climate change creates persistent downward pressure on growth, structurally higher deficits and rising debt vulnerabilities

Source: Author, based on literature review

The evidence converges: climate change leads to lower GDP growth, higher fiscal deficits and rising debt — each one a direct consequence of damages, adaptation needs and transition costs. These features interact to worsen debt dynamics (Avgousti et al., 2023). Slower growth reduces the denominator of the debt-to-GDP ratio while also eroding tax revenues, and higher deficits expand the numerator through greater borrowing needs. This dual effect increases concerns about long-term

debt sustainability, leading investors to demand higher risk premia on sovereign debt. Without credible policy responses, this can trigger a self-reinforcing cycle of rising interest burdens and debt accumulation. Traditionally, governments have responded through fiscal consolidation, but if consolidation is implemented hastily or during periods of weak growth, it can further depress economic activity, undermine public investment and delay the climate transition — ultimately aggravating the very fiscal and economic vulnerabilities it aims to address.

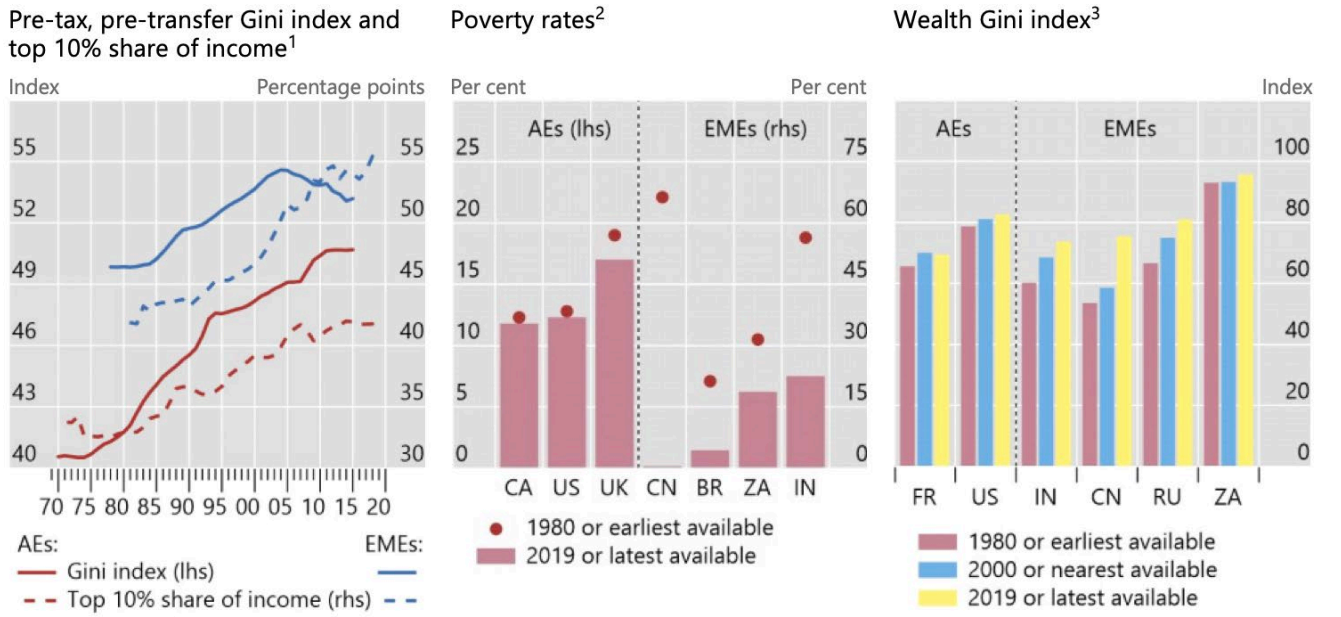
3.3. Climate change and redistributive consequences: additional fiscal pressure with a political economy dimension

Beyond the macro-fiscal tensions, lies an additional challenge with profound redistributive and political consequences: climate change disproportionately impacts low-income households. These unequal burdens generate additional fiscal pressure, as governments are called upon to expand social protection, subsidise basic needs and invest in resilience. At the same time, the political effects of rising inequality, manifested in social discontent and resistance to climate policies that are perceived as unfair, can further constrain fiscal choices and undermine the credibility of consolidation or transition strategies.

Climate change disproportionately affects the poor, who are worst hit by its hazards. Low-income households are often more exposed, living in flood-prone areas or informal housing, and have precarious livelihoods that are highly vulnerable to heat stress and climate-sensitive sectors. They also tend to have poorer underlying health and limited access to cooling, both of which significantly increase their exposure to the health and productivity consequences of extreme heat (WHO, 2023). They have weaker buffers, with limited savings or access to insurance, making them less able to absorb shocks. On top of this, they are more exposed to food and energy price increases, which weigh heavily on household budgets. Global assessments consistently show that, without strong adaptation and robust social protection systems, climate change acts as a powerful poverty multiplier, inflicting the greatest welfare losses on the poorest populations.

The impact of climate change on inequality compounds a long-running trend. Since the 1980s, income inequality has risen steadily across most advanced economies and, increasingly, in large emerging markets. This reversal of the post-war decline reflects a combination of structural and cyclical forces. Technological progress and globalisation have boosted the returns on skills, raising the income of highly educated workers while depressing the bargaining power of the less skilled. At the same time, labour market changes, such as deindustrialisation, the growth of non-started and precarious work, and weaker unionisation, have further reinforced these pressures. Recessions since the early 1980s have also left lasting scars, disproportionately affecting low-income workers and producing what recent research calls ‘inequality hysteresis’: a persistence of higher inequality long after output recovers.

Figure 3.1. Inequality on the rise amid declining poverty rates



[1] Pre-tax, pre-transfer Gini index is calculated using the amount of money coming into the household pre-tax, excluding government cash or near-cash benefits. Top 10% share of income represents pre-tax national income share held by the top 10% earners in the population. Weighted averages of selected economies, based on 1980 GDP and PPP exchange rates. AEs = CA, DE, FR, JP, the UK and the US; EMEs = BR, CN, IN and ZA. [2] For AEs, poverty headcount ratio at the national poverty line is used. For EMEs, a common poverty headcount ratio at US$1.90 a day (2011 purchasing power parity) is used. For CA, (1981, 2018); for US, (1989, 2019); for UK, (1995, 2018); for CN, (1990, 2016); for BR, (1981, 2018); for ZA, (1993, 2014); for IN, (1983, 2011). [3] For FR, (1980, 2000, 2014); for US, (1980, 2000, 2019); for IN, (1981, 2002, 2012); for CN, (1980, 2000, 2015); for RU, (1995, 2000, 2015); for ZA, (1993, 2000, 2017).

Source: Pereira da Silva et al. (2022) using the following data sources: Federal Reserve Bank of St Louis, FRED; OECD; World Bank; Standardized World Income Inequality Database (SWIID); World Inequality Database (WID); Datastream; national data; BIS calculations

Fiscal policy, traditionally the main tool for offsetting these trends, has paradoxically contributed to their entrenchment. Starting in the 1980s, many governments flattened income tax systems, reducing progressivity at the top end. This shift eroded the redistributive effect of taxation, leaving disposable incomes more unequal than in earlier decades. At the same time, unemployment insurance schemes were cut back, lowering replacement rates and weakening the social safety net. Both developments meant that automatic stabilisers such as progressive taxes and social transfers that normally cushion shocks became less powerful. As a result, governments collected less revenue during booms and provided less income support during recessions, diminishing the countercyclical role of fiscal policy.

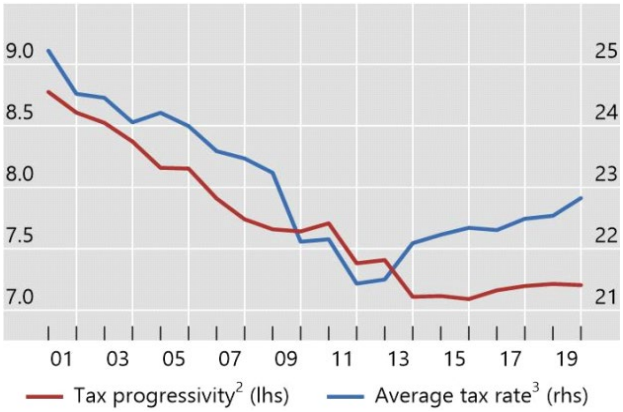
The outcome has been a double bind: not only has fiscal redistribution done less to reduce inequality, but its reduced countercyclicality has also contributed to larger and more persistent recessions, which in turn feed back into greater inequality. In effect, by scaling back tax progressivity and unemployment insurance, fiscal systems became less effective both at stabilising the business cycle and at containing income disparities. This shift has placed heavier reliance on monetary policy as the 'only game in town', even though inequality itself weakens the traction of monetary stimulus (see Pereira da Silva, 2022).

Figure 3.2. Scaling back tax progressivity and unemployment insurance

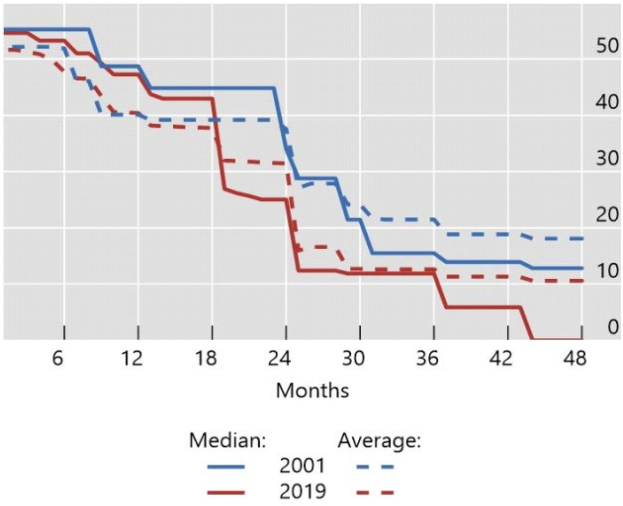
Tax progressivity has been steadily falling in AEs

In per cent — Graph 1

Cross-country average tax progressivity close to historical lows while tax burden recovering since 2011[1]



Cross country unemployment replacement rate[4]



[1] Country sample: AT, AU, BE, CA, CH, DE, DK, EE, ES, FI, FR, GB, GR, IE, IS, IT, JP, LT, LU, NL, NO, NZ, PL, PT, SE and US. [2] Tax progressivity is estimated for each country and year as the semi-elasticity of average personal income tax rate to personal income. Average personal income tax rates are computed based on marginal tax rates for different income brackets for 100 hypothetical personal incomes, from 4% to 400% of GDP per capita with a 4 percentage point increment. [3] Average tax rate is the mean across countries of average personal income tax rates, averaged over the 100 hypothetical personal incomes. [4] Cross-country average and median across six different family statuses (single w/o children, couple without children and partner in/out of work, couple with children and partner in/out of work). Country sample: AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, IT, JP, NL, NO, NZ, PT, SE and US.

Source: Pereira da Silva et al. (2022) drawing on OECD data and own calculations

Avoiding a negative sociopolitical feedback loop is essential. Experience in high-income democracies shows that when climate policies are perceived as unfair, they can trigger a backlash and feed populist narratives that stall or even reverse progress, as illustrated by France's *Gilets Jaunes* movement. Although the protests were sparked largely by a planned rise in standard fuel taxes amid broader grievances over living costs and inequality, the episode nonetheless revealed how sharply households can react to higher energy prices when compensation is weak or unclear.

Such reactions often arise because households overestimate their net losses or doubt the effectiveness of environmental measures. Empirical evidence shows that transparency about how revenues are used, clear earmarking for visible purposes and progressive forms of compensation significantly increase public support for climate policy. Recent survey experiments across multiple countries also demonstrate that perceived policy effectiveness, fairness towards low-income households and self-assessed household impacts strongly shape acceptance (Dechezleprêtre et al., 2025).

Crucially, shaping beliefs about who bears the costs and who reaps the benefits matters as much as the actual distributional outcomes. Every credible carbon-mitigation package should embed compensatory fiscal transfers (e.g. lump-sum dividends or targeted rebates for low- and middle-income households), paired with complementary measures (public transit, building retrofits, rural support) and clear, routine communication on who pays/benefits (van der Ploeg, 2023).

This is not only a fairness requirement but a macro-stability one: it prevents a vicious circle where climate policy breeds discontent, empowers obstruction and delays action — increasing long-term costs and inequality. Recent syntheses show that well-designed recycling can protect the bottom deciles, maintain incentives and preserve revenue for strategic investment.

Poverty and social protection needs create an additional source of fiscal pressure. Without adaptation, climate change could push tens of millions back into poverty by 2030, particularly in low-income and climate-vulnerable countries, requiring substantial scaling-up of social transfers (Abalo et al., 2025). In many low-income countries, adaptation-related social protection could reach 1–3% of GDP annually, including 1.5–2% of GDP in sub-Saharan Africa by 2030 to protect the poorest deciles.

Carbon pricing also requires compensatory measures because fuel and energy taxes weigh more heavily on low-income households. When revenues are recycled through targeted transfers, dividends, or investment in affordable alternatives, carbon pricing can become progressive and politically acceptable. Estimates suggest that compensating lower-income households for a US$50/tonne CO_2 tax costs around 0.3–0.6% of GDP in advanced economies and 1–1.5% of GDP in emerging markets, which is broadly consistent with the experience of countries, for example Indonesia's during fossil fuel subsidy reforms (0.7% of GDP in 2015) and France's after the *Gilets Jaunes* protests (0.4% of GDP in 2019) (IMF, 2019, 2022)

Food and energy price shocks linked to climate change can further strain vulnerable households. Physical hazards such as droughts, heatwaves and extreme weather are already generating short-term inflationary pressures through their negative impacts on the supply side of the economy. Food prices, which are particularly sensitive to climate variability, are among the most affected. As climate change intensifies, the frequency, magnitude and persistence of these inflationary pressures are likely to increase. Recent projections indicate that as early as 2035, increases in average temperatures could contribute on average 0.92–3.23 pp annually to food inflation and 0.32–1.18 pp annually to headline inflation globally (see Barmes et al., 2024). These increases could represent more than half of the 2% inflation target of most central banks in advanced economies operating under inflation-targeting regimes, posing risks to both macroeconomic stability and social equity.

Compensation schemes have been put in place in OECD countries to address these inflationary pressures, typically costing 0.5% of GDP, and rising to more than 2% of GDP in energy-importing EMDEs during crises. Overall, the evidence suggests that climate-related social protection and compensatory transfers generate additional fiscal pressures on the order of 0.3–3% of GDP annually, depending on income levels and vulnerability.

While these measures add to short-term fiscal pressures, the broader macroeconomic effects of the transition depend critically on the growth impact of climate investment itself.

A central premise of the adaptive fiscal framework is that climate investment is not merely a cost but a powerful source of medium-term growth, which directly improves public debt dynamics and supports the political acceptance of a temporary 'green debt hump'. Recent evidence, including Stern's (2025) articulation of a new growth and development model (see Box 3.1.), shows that large-scale investment in clean energy, resilient infrastructure and modern urban systems generates higher productivity, stronger innovation spillovers and lower macro-financial risk than the fossil fuel-based growth path it replaces. In quantitative terms, the transition requires increasing the global investment rate by roughly 2 pp of GDP, and by 3 to 5 pp in emerging economies. Standard Harrod–Domar logic suggests that an increase of this magnitude can lift long-run growth by 0.3 to 0.5 pp annually. Learning curves in renewables, advances in storage and artificial intelligence (AI) and reduced exposure to climate shocks further lower the incremental capital–output ratio, reinforcing the growth effect.

These gains contrast sharply with the pessimistic view that climate shocks inevitably generate a protracted slump. While unmanaged climate impacts do depress growth — meta-analyses project global per capita GDP losses of around 8% by 2050 under current policies — well-designed climate investment reverses this trajectory by reducing risk premia, stabilising energy costs and unlocking new sectors and jobs. For fiscal policy, this distinction is crucial: by raising trend growth and reducing volatility, climate investment improves the denominator of the debt-to-GDP ratio and helps to mitigate the temporary increase in public borrowing required to finance adaptation and mitigation. In this sense, the growth dividend from climate action is not a secondary co-benefit but an essential macroeconomic foundation for managing and ultimately reducing the green debt hump in a socially and politically sustainable way.

Box 3.1. Climate investment as a driver of 21st-century growth (from Stern, 2025)

A central argument of Stern (2025) is that climate investment is not a constraint on economic performance but a primary engine of sustainable, resilient and inclusive growth. Climate investment is the foundation of a superior growth model, characterised by higher resource efficiency, lower volatility, rapid technological progress and improved human well-being.

The new growth model that emerges from climate action differs fundamentally from the fossil fuel-based model of the 20th century. It is characterised by higher resource efficiency, lower volatility, strong technological progress and improved social and environmental outcomes. Fossil fuel-intensive development has become economically inferior as climate damages rise and clean technologies continue to fall rapidly in cost. The transition to clean energy, modern infrastructure and resilient systems constitutes a structural shift comparable to past technological revolutions.

Climate investment fosters growth through several transmission mechanisms. First, the transition requires sustained increases in capital formation across energy, transport, buildings, land use and urban systems. These investments generate immediate demand effects, crowd in private capital, modernise the capital stock and embed more productive technologies.

Second, clean technologies display steep learning curves and strong spillovers: costs fall rapidly with deployment, as illustrated by solar PV costs falling from US$0.80/W in 2015 to around US$0.10/W in 2025.

Third, investment in resilience reduces exposure to climate shocks, energy-price volatility, and sovereign risk, thereby lowering risk premia and the cost of capital.

Fourth, the co-benefits — reduced air pollution, improved health, higher labour productivity and more efficient urbanisation — further reinforce growth prospects.

Fifth, emerging economies can leapfrog directly to advanced clean technologies, avoiding obsolete fossil infrastructure and benefiting from abundant renewable resources.

These effects are underpinned by several structural drivers highlighted by Stern:

- Rapid technological progress that has made clean energy cheaper than fossil alternatives for many applications
- The scale of required investment, which anchors an investment-led growth cycle
- Cost reductions through learning, innovation and global diffusion
- Declining economic and financial risks as resilience improves
- Avoided climate damages that preserve productivity and capital
- Improvements in health and human capital
- Reforms that strengthen institutions and mobilise finance at scale

Taken together, these mechanisms imply that climate action is the most powerful and reliable driver of global growth in the 21st century and the only development path consistent with long-term stability and prosperity.

Crucially, Stern (2025) provides quantitative estimates of the growth impact of this new model. He notes that the climate transition will require raising the investment share of GDP by about 2 pp globally, and by 3–5 pp in emerging and developing economies (except China) to meet net zero and resilience needs. Using the Harrod–Domar logic, Stern calculates that a 2 pp increase in global investment could raise the world growth rate by roughly one-third to one-half of a percentage point per year, even before accounting for technology spillovers.

Stern further emphasises that innovation, efficiency gains and increasing returns to scale — especially in renewables, storage, green industry and AI — reduce the incremental capital–output

ratio (ICOR), meaning that each unit of investment produces more growth than under the old fossil fuel-based model.

Additional medium-term gains arise from improved balance-of-payments positions, as countries shift from imported fossil fuels to domestically produced clean power; India's fossil fuel import bill exceeded 4% of GDP in 2021.

Together, these mechanisms imply that the climate-investment-led growth model can deliver systematically higher, more stable and more inclusive growth than the high-carbon alternative.

4. Traditional policy responses to high debt and fiscal pressure: fiscal consolidation

Confronted with the combined pressures of lower growth, higher debt and wider deficits, the traditional macroeconomic response has been to seek fiscal consolidation. Higher debt will trigger additional negative effects on growth. Therefore, the traditional logic is straightforward: by tightening fiscal policy, governments can demonstrate commitment to sustainability, lower sovereign risk premia and restore a credible trajectory for public accounts. In this framework, fiscal consolidation is considered to be the most appropriate course of action, since in some circumstances it can even prove expansionary — strengthening confidence, reducing borrowing costs and crowding in private investment.

4.1. Climate risk and sovereign risk premia

High public debt tends to depress long-run growth. A recent review covering 70 studies (2010–2025) finds a strong consensus that higher public debt lowers long-run growth: most studies report a negative effect of debt on growth, with many identifying non-linear thresholds beyond which the drag accelerates (Salmon, 2025). For advanced economies, these thresholds are typically around 75–80% of GDP. The mechanisms include crowding out of private investment, higher long-term interest rates, increased inflation and credit-risk premia, and precautionary saving responses by households. The overall policy implication is that maintaining debt ratios below such thresholds reduces the growth drag and preserves fiscal space — crucial in a world of rising climate-related spending needs.

Climate risks are increasingly being priced into sovereign borrowing costs and credit ratings. In recent years, investors and credit rating agencies have begun to factor both physical climate risks and transition risks into their assessments of sovereign creditworthiness (Coalition of Finance Ministers for Climate Action, 2025). Countries that are highly exposed to climate hazards such as rising sea levels, droughts, heatwaves and cyclones are finding that their vulnerability translates into higher sovereign bond spreads and, in some cases, ratings downgrades (Cevik and Jalles, 2020a). The impact is particularly acute for economies with limited fiscal space and weak adaptive capacity, where the anticipated costs of disaster recovery, infrastructure repair and social support weigh heavily on debt sustainability projections (Kling et al., 2025; Beirne, Renzhi and Volz, 2021).

Sovereign credit ratings provided by the major agencies — Standard & Poor's, Moody's and Fitch — rely on broad assessments of economic strength, fiscal performance, institutional quality and external resilience. While each agency uses its own proprietary methodology, their frameworks converge around a common set of criteria, including GDP per capita, growth prospects, diversification and structural vulnerabilities. Fiscal assessments examine debt levels, deficits, revenue-raising capacity and the credibility of medium-term fiscal frameworks. Monetary and financial indicators cover the credibility of the central bank, inflation dynamics, exchange rate stability and financial sector soundness. Institutional and governance factors, such as rule of law, transparency and political stability, also influence repayment capacity. External indicators include current account balances, external debt burdens, foreign exchange reserves and access to global capital markets. Recently, rating agencies have begun to integrate climate and environmental risks into these frameworks, recognising that both physical shocks and transition pressures can materially affect long term creditworthiness.

Taken together, these criteria form a composite judgment of a sovereign's ability and willingness to honour its debt obligations, guiding investors in their perception of risk premia. Although methodologies differ in detail — Moody's 'scorecard', Standard & Poor's 'institutional–economic–external–fiscal–monetary' framework and Fitch's 'structural–macroeconomic–public finance–external finance' pillars — the underlying dimensions are remarkably consistent across agencies. Debt-to-GDP remains a central indicator, as it serves as a proxy for a government's repayment capacity relative to the size of its economy. This is assessed alongside the trajectory, composition of debt (domestic versus external, local currency versus foreign currency, short-term versus long-term maturities) and the credibility of fiscal policy.

A higher debt-to-GDP ratio does not automatically imply weak creditworthiness when accompanied by strong growth prospects, low interest costs, deep domestic capital markets and sound institutions, as illustrated by advanced economies with high but stable debt levels (Emambakhsh et al., 2023). However, for emerging and middle-income economies with weaker macro-fiscal buffers, rising debt is often associated with higher risk premia and ratings pressures (Cevik and Jalles, 2020a; Kling et al., 2025; Beirne, Renzhi and Volz, 2021).

Physical climate shocks increasingly translate into market penalties. Empirical evidence shows that major climate events, such as severe storms in the Caribbean or prolonged droughts in Southern Africa, can damage productive capacity, reduce export earnings and require substantial emergency spending, deteriorating fiscal positions (IMF, 2020; Acevedo et al., 2020). Rating agencies often adjust outlooks downward following such events, especially when shocks recur or when adaptation plans are weak, reinforcing perceptions of systemic vulnerability.

Transition risks also generate long-term fiscal and macroeconomic challenges. Export-dependent fossil fuel producers face stranded-asset risks and declining revenues as global demand falls. Economies with carbon-intensive industries may incur significant adjustment costs from new trade measures such as carbon border adjustment mechanisms (CBAMs) or tightening environmental standards. These pressures can erode fiscal revenues, increase unemployment in affected sectors and heighten political instability, all of which feed into sovereign risk assessments (Bolton et al., 2020).

However, it must also be acknowledged that **higher climate resilience is associated with better sovereign ratings and lower borrowing costs**, especially for EMDEs. Cevik and Jalles (2020a, 2020b) make a two-part argument: while climate vulnerability does significantly lower ratings, climate resilience has a positive and statistically significant effect on sovereign ratings, even after controlling for standard macro and institutional variables. Countries that score more highly on resilience enjoy measurably better ratings.

Despite recent progress, market and rating agency responses to climate risk remain uneven. Some highly exposed countries retain favourable borrowing conditions despite limited adaptation efforts, suggesting a lag in comprehensive risk pricing (Beirne, Renzhi and Volz, 2021). Conversely, vulnerable economies can face disproportionate penalties even when pursuing climate-resilient policies, reflecting information gaps and investor biases. This inconsistency underscores the need for better sovereign climate risk disclosure, forward-looking scenario analysis and systematic integration of climate factors into sovereign risk frameworks.

Recent empirical research further reinforces these dynamics, as summarised in Box 4.1, which synthesises the latest evidence on how physical and transition risks affect sovereign credit ratings and borrowing costs (Cevik and Jalles, 2020b; Kling et al., 2025; Battiston and Monasterolo, 2020; Eren, Mertens and Verhoeven, 2022; FSB, 2020).

Finally, it is also important to note that sovereign debt sustainability is often analysed from the supply side — how much governments issue. But borrowing costs also depend on the structure of demand for public debt. Several structural forces are increasing global demand for safe, long-duration sovereign assets:

- Ageing populations that favour lower-risk portfolios
- Heightened geopolitical and climate uncertainty that shifts investors towards high-quality collateral

- Regulatory changes that expand the role of sovereigns in institutional balance sheets

In this environment, well-designed green sovereign bonds can position themselves as preferred assets, potentially benefiting from both the search for safety and the search for sustainability-aligned fixed income (Monnin et al. 2024).

Box 4.1. Climate risks and sovereign credit ratings: key findings from recent research

A growing body of empirical and theoretical research demonstrates that climate risks — both physical and transition-related — are increasingly material to sovereign creditworthiness. These risks influence sovereign bond yields, spreads and ratings through macroeconomic shocks, fiscal vulnerabilities and financial market reactions.

Physical climate shocks such as heatwaves, droughts and storms already exert a significant adverse effect on sovereign borrowing costs. Using panel data for over 100 advanced and developing countries, Cevik and Jalles (2021) show that higher exposure to climate vulnerability increases government bond yields and spreads but climate resilience decreases them. Indeed — and this result is important for debt financing of the transition — there is now a small but consistent body of work showing exactly that. Higher climate resilience is associated with better sovereign ratings and lower borrowing costs, especially for EMDEs (Cevik and Jalles, 2020a, 2020b).

Kling et al. (2025) document that developing countries with high climate vulnerability exhibit a higher cost of debt (1.174% on average) after controlling for conventional macroeconomic and fiscal factors. They estimate that the cost of debt for 40 members of the Vulnerable Twenty Group (V20) from 2007 to 2016 amounted to US$62 billion.

Looking beyond physical risks, transition risks arising from climate policy shifts and stranded assets also pose challenges. Battiston and Monasterolo (2020) show that traditional risk management tools (value at risk and expected shortfall) might underestimate climate risk. This is because a higher probability of an adverse climate transition increases the probability of a default on bonds sharply, even if portfolio loss estimates remain relatively stable. They find that countries with carbon-intensive economies pay a climate premium affecting sovereign risk and portfolio performance. They call for a wide set of scenarios (including extreme ones) to be incorporated into climate stress-testing to avoid the underestimation of losses.

In line with this, the Coalition of Finance Ministers for Climate Action (2025) detail how climate scenario analysis tools, such as the IMF's Quantitative Climate Change Risk Assessment Fiscal Tool, should be part of finance ministries' macroeconomic assessments to better integrate physical risks and adaptation into their decision-making. They can help in understanding the overall economic and fiscal effects of physical climate risks and identify potential adaptation and mitigation solutions, as well as their financing options, in order to ensure resilience and fiscal stability.

These risks matter for sovereign ratings because both physical shocks and transition dynamics weaken growth, public finances and external balances — direct inputs into rating-agency models. Climate-scenario tools such as the IMF's Quantitative Climate Change Risk Assessment Fiscal Tool therefore help Ministries of Finance assess how climate shocks interact with macro-fiscal variables and identify adaptation or mitigation responses that preserve fiscal stability.

At the systemic level, mispricing or under-pricing of climate risks can spill over into sovereign creditworthiness. If climate risks are not fully reflected in financial markets, borrowing costs may become more volatile, market access can tighten during shocks and rollover risks increase — channels that rating agencies monitor closely. Eren, Merten and Verhoeven (2022) review the broader literature on financial market pricing of climate-related physical and transition risks and highlight several frictions (limited risk-sharing, scarce hedging instruments, incomplete information) that contribute to inconsistent climate-risk pricing.

From a financial stability perspective, the Financial Stability Board (FSB) (2020) warns that climate change and extreme natural catastrophes may undermine debt sustainability in EMDEs, with

potential spillovers to bank balance sheets and broader financial stability. The risk is more pronounced in areas with existing high sovereign exposures (e.g. due to the Covid-19 pandemic) as climate shocks can interact with existing vulnerabilities. The FSB calls for better monitoring of different climate risk metrics and consistent use of climate-related data across jurisdictions and supervisors (FSB, 2025).

4.2. The debate on the sign of fiscal multipliers: 'expansionary austerity' versus 'contractionary fiscal expansions'

The traditional Keynesian argument for fiscal expansion rests on the positive fiscal multiplier effect. When governments increase spending or cut taxes, aggregate demand rises directly through higher public consumption and investment, and indirectly as households and firms respond with higher private spending. This initial injection circulates through the economy, as each round of income generated fuels further consumption and production, leading to a magnified impact on output and employment. In the short run, especially under conditions of underutilised capacity or high unemployment, such fiscal stimulus is expected to lift aggregate demand above its previous equilibrium, spurring higher growth and reducing output gaps.

However, two mirror-image claims have shaped fiscal policy debates since the 1990s. First, expansionary austerity: under some conditions, a credible fiscal consolidation can raise output in the short run (Alesina and Ardagna, 2010). Second, contractionary fiscal expansions: a fiscal stimulus can reduce output if it triggers offsetting forces (higher risk premia, tighter monetary policy, currency appreciation, supply constraints) (Giavazzi and Pagano, 1990; Blanchard and Perotti, 2002; Ramey, 2011). Both propositions are state-dependent: the effects hinge on the initial conditions, policy mix and macro-financial regime.

How could consolidation be expansionary? In certain conditions, fiscal consolidation can boost rather than depress economic activity. Through the risk premium/interest rate channel, a front-loaded and credible adjustment can reassure markets when debt sustainability or inflation risks are salient, compressing sovereign spreads and long-term rates, and lowering private borrowing costs and stimulating investment.

A second mechanism is confidence and expectations: if households and firms believe that credible medium-term consolidation will reduce future tax burdens and macroeconomic risks, uncertainty falls, which can encourage durable goods consumption and business hiring.

Further, the composition and supply effects of consolidation matter: when based on cuts to unproductive spending or subsidy reforms and combined with structural measures, such adjustments can raise expected future income and enhance potential growth.

Finally, in small open economies, an external channel may operate: lower risk premia under flexible exchange rates can lead to currency depreciation (or prevent appreciation), improving net exports.

When does the evidence support this? Historical case studies (e.g. Denmark/Ireland in the late 1980s) and cross-country panels have been cited to show episodes where spending-led consolidations coincided with growth. Subsequent research, however, stresses that:

- Many 'successes' occurred alongside supportive monetary policy, currency depreciation, or global upswings
- Identification matters — using cyclically adjusted balances can bias results
- On average, consolidations are contractionary in the short run, with smaller costs when they rely more on spending cuts than tax hikes and when they occur in expansions rather than recessions

How can stimulus be contractionary? Under certain circumstances, fiscal stimulus may reduce rather than raise aggregate demand. A key mechanism is the monetary policy offset: when inflation is at or above target and central banks have room to act, they may respond to fiscal expansion by raising interest rates, crowding out private demand. The risk-premium channel can also work against stimulus,

as higher debt and rollover risks may push markets to demand larger spreads, raising borrowing costs and offsetting the demand boost.

On the supply side, price pressures can emerge when the economy is near capacity, with stimulus exacerbating bottlenecks and import leakages; this compresses real income via inflation or an appreciated currency that erodes net exports. Moreover, Ricardian and expectations effects may weaken stimulus: households anticipating future tax hikes or viewing measures as poorly targeted may choose to save rather than spend.

Finally, the composition of stimulus matters — transfers with a low marginal propensity to consume or capital expenditures that take time to execute can yield limited short-term multipliers, even if they support medium-term growth.

What does the broader evidence say? The empirical record shows that multipliers are state-dependent: they tend to be larger during recessions, at the zero lower bound, under fixed exchange rates and when economic slack is abundant (Auerbach and Gorodnichenko, 2012; Christiano, Eichenbaum and Rebelo, 2011). By contrast, they are smaller in booms when inflationary pressures rise and monetary policy tightens independently (Ramey, 2011; Ramey and Zubairy, 2018). Evidence also indicates that consolidations usually reduce output in the short run, with tax-based adjustments being particularly contractionary, while spending-based ones generally have smaller, though still negative, effects (Guajardo, Leigh and Pescatori, 2014; IMF, 2010). Over the medium to long run, outcomes hinge on hysteresis and credibility. Deep recessions risk permanently damaging potential output, but well-designed public investment and credible medium-term fiscal anchors can help offset short-run costs and strengthen future productive capacity (Blanchard, Cerutti and Summers, 2015).

The key policy takeaway is: the sign of fiscal multipliers is not a structural constant. Short-run outcomes depend on initial debt and spreads, output gap, monetary/exchange-rate regime, composition/timing/credibility of measures and external conditions. In environments with slack and supportive monetary policy (or constrained rates), stimulus is probably expansionary; when debt stress is acute and policy credibility is at risk, consolidation can limit damage and, in rare cases, be expansionary — typically when accompanied by pro-growth reforms and favourable external/monetary conditions.

For climate-related investment, the risk-premium channel cautions that credible, well-governed green investment programmes can crowd in private capital and lower spreads, whereas abrupt consolidation that cuts productive green capex may be self-defeating.

Box 4.2. Fiscal multipliers, austerity and state-dependent effects: a literature overview

Modern empirical study of fiscal multipliers began with Blanchard and Perotti (2002), who introduced a structural vector autoregressions (VAR) framework to identify government spending and tax shocks on economic activity, finding significant effects of fiscal policy on output in the post-war US.

Ramey (2011) reviews US and cross-locality evidence for fiscal multipliers that made a comeback with the financial crisis, showing that the bulk of estimates of multipliers from a temporary rise in government purchases are probably between 0.8 and 1.5 — lower than in traditional Keynesian models. A new review of evidence by Ramey in 2019 even suggests that multipliers in developed countries range from 0.6–1, meaning that multipliers raise GDP but may lead to some crowding out of private activity. While evidence that spending multipliers are higher during economic downturns is fragile, evidence that multipliers are higher when monetary policy is accommodative is stronger (Ramey, 2019).

A contrasting line of work suggested that even fiscal contractions could be expansionary. Giavazzi and Pagano (1990), studying Ireland and Denmark, argue that fiscal consolidation could signal a permanent reduction in government spending, thereby fuelling expectations of lower future taxes and raising private consumption. Alesina and Ardagna (2010) compare fiscal stimuli based on tax cuts with those based on spending increases, and find that the former are more likely to increase growth.

Fiscal consolidations based on spending cuts, in turn, are more likely to lower deficits and debt/GDP ratios and less likely to create recessions than those based on tax increases. Fiscal adjustments based on spending cuts are also less likely to be reversed, and can even be expansionary in some cases (Alesina and Ardagna, 2013). Perotti (1999) emphasises that the macroeconomic effects of fiscal policy depend on initial economic conditions, with fiscal (expenditure) shocks having Keynesian effects when debt and deficit are low, and non-Keynesian effects in the opposite case.

These claims have provoked substantial reassessment. The IMF's *World Economic Outlook* (2010) finds that consolidations typically reduce domestic demand in advanced economies in the short run. Guajardo, Leigh and Pescatori (2014) suggest that conventional measures of fiscal policy stances seem to overstate the expansionary effects of fiscal contractions. Using a new dataset assembling fiscal consolidation motivated by deficit reductions (and not responding to prospective economic developments), they estimate that fiscal consolidations are contractionary. Blanchard and Leigh (2013) provide further evidence by demonstrating that the IMF's own growth forecasts systematically underestimated multipliers during the post-2008 crisis, explaining why consolidating economies performed worse than expected. Jordà and Taylor (2015) reach similar conclusions (austerity is always a drag on growth, especially in depressed economies) using novel propensity-score based methods, while Ilzetzki, Mendoza and Végh (2013) highlight how multipliers vary with key characteristics of countries, being larger in advanced economies and under fixed exchange rates, but smaller in developing countries and open economies. Likewise, Auerbach and Gorodnichenko (2012) document that multipliers are strongly state-dependent — with fiscal policy largely being more effective in downturns.

The interaction between fiscal and monetary policy is central to understanding these dynamics. Woodford (2011) shows that fiscal multipliers rise substantially (>1) at the zero lower bound (ZLB), as fiscal expansion causes the real interest rate to decline. DeLong and Summers (2012) argue that when short-term nominal interest rates are at the ZLB in depressed economies, fiscal stimulus may even be self-financing as it mitigates hysteresis (lasting scars to potential output), thus justifying their stabilisation policy mission.

Batini, Callegari and Melina (2012) examine the optimal pace of fiscal consolidation in the US, the euro area and Japan. They suggest that debt-to-GDP ratios are more likely to be lowered by a gradual fiscal consolidation, and that monetary policy can play a role in 'alleviating' the pain.

Corsetti et al. (2013) point out that the multiplier can be reduced by the sovereign risk channel, with sovereign default risk increasing private funding costs, when the central bank is constrained, especially when public finances are particularly fragile and the ZLB is persistent.

More recent research also stresses the medium-term implications of fiscal choices. Fatás and Summers (2018) find that a significant part of the long-term GDP reduction after the global financial crisis is a direct result of the fiscal consolidation in 2009–2011, suggesting that attempts to reduce government debt through fiscal consolidation can fail because of long-term reductions in GDP. Blanchard, Cerutti and Summers (2015) confirm such hysteresis effects, demonstrating that recessions are followed by lower output compared to the pre-crisis trend even after the economy recovers.

Finally, some studies underline crowding out and open-economy channels. Barro and Redlick (2011) look at defence spending and argue that fiscal expansion can crowd out other components of GDP, such as investment and non-defence government purchases or net exports (i.e. the multiplier is less than one). Perotti (2007) focuses on developing countries, emphasising that the optimal cyclical behaviour of fiscal policy depends on the interactions of "credit market imperfections at the individual, firms, or government level, and on the supply of external funds to the country".

Taken together, the literature shows that fiscal multipliers are not constant but depend on context, the state of the cycle, monetary stance, debt levels and country characteristics. The early claims of 'expansionary austerity' have been largely overturned, with most evidence now suggesting that fiscal consolidations are contractionary, while well-timed fiscal expansions, especially in recessions or at the ZLB, can have powerful and persistent positive effects on output.

4.3. Counterfactuals: rising debt under exceptional scenarios and a missed opportunity

History also shows that there are moments when a growth in debt is inevitable, and fiscal consolidation is neither feasible nor desirable in the short term. Wars are the classic example: extraordinary spending to preserve the state and society is financed through surging debt, to be managed only once the crisis has abated. Climate change may bear similar traits, as the costs of inaction could far outweigh the risks of temporarily higher debt.

To frame today's fiscal challenge with another angle, there are historical precedents for a surge in public debt — for example during the First and Second World Wars — that can be compared to the investment needs of the climate transition (see Box 4.3). In both wars, governments could not raise taxes fast enough to match spending, so they relied on borrowing, central planning and wholesale industrial mobilisation, and then worked debt down over time through growth, moderate inflation, primary surpluses and regulated funding costs. The lesson is not nostalgia for command economies, nor for advocating some form of military Keynesianism, but clarity about sequencing: when the objective is existential and time-critical, front-loaded, investment-driven borrowing is less risky than underinvesting and absorbing compounding losses. Box 4.3 distils why taxes alone were insufficient, how coordination and market management contained macro risks and what this implies for a temporary, well-communicated 'green debt hump' within adaptive, state-contingent fiscal frameworks today.

Box 4.3. Wartime debt surges and today's climate 'war': lessons for fiscal strategy

Wartime debt dynamics

In both the First and Second World Wars, the belligerents experienced explosive increases in public debt because military outlays far outstripped the state's near-term capacity to raise taxes (Broadberry and Harrison, 2005). Debt ratios peaked at historically unprecedented levels; in the US, for example, it was above 100% of GDP in 1946, and the UK it was around 250–270% before being worked down over subsequent decades through growth, moderate inflation, primary surpluses and explicit 'financial repression' (interest rate caps, captive demand, regulations).

Why taxation could not simply 'pay for the war'

Contemporary economists argued that taxes alone could not, and should not, carry the full burden at the speed required for total war. Keynes (1940) proposed a mix of higher taxes with compulsory saving/deferred pay to restrain civilian demand and curb inflation, precisely because the administrative and political capacity to hike taxes quickly enough was limited and because maintaining both minimum civilian consumption and morale was strategically essential. Subsequent scholarship documents how governments relied on borrowing (war bonds), money finance, price controls and rationing to bridge the gap while tax systems were retooled and broadened.

Central planning and general industrial mobilisation

War economies adopted central planning mechanisms — allocating raw materials, setting priorities, fixing prices/wages and coordinating logistics — to convert civilian capacity into munitions at speed. In the US, institutions such as the War Production Board and the Office of Price Administration redirected entire sectors (automobiles → tanks/aircraft; consumer durables → armaments), while the UK, Germany, the USSR and Japan each developed their own command systems; economists have shown that such coordination, with price controls (Galbraith, 1952) rather than price signals alone, was decisive for output surges and cost control.

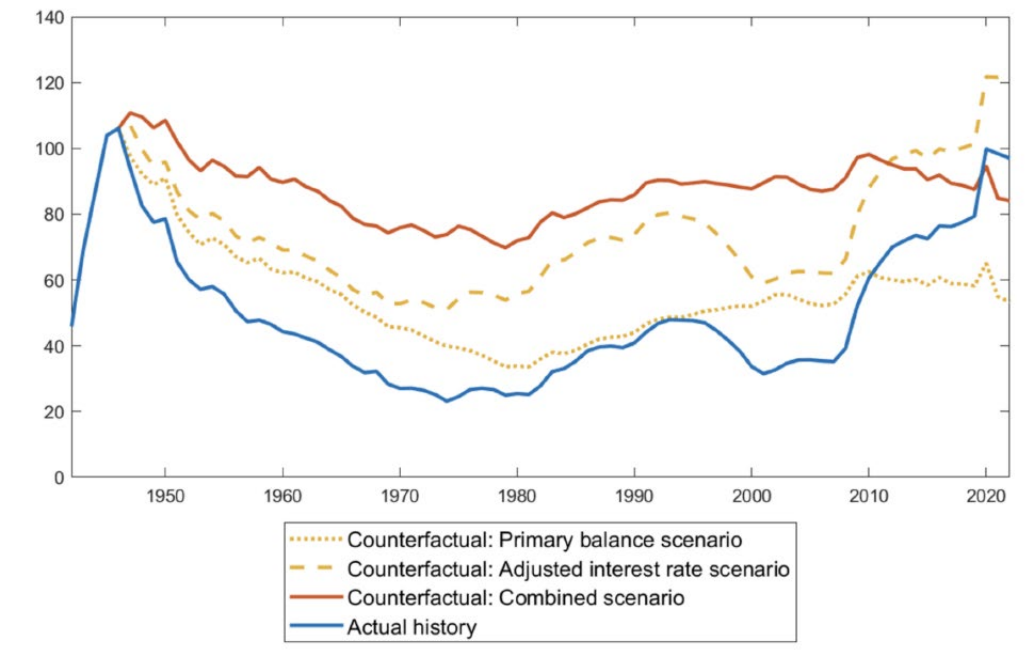
How the debt was later reduced

After the Second World War, countries did not lower their debt ratios by sudden austerity, but rather through a package: maintaining primary surpluses as reconstruction proceeded; financial

repression that kept funding costs below nominal growth; and sustained real growth as capacity shifted back to civilian production — patterns documented in modern debt histories (Crafts, 2016).

Acalin and Ball (2023) conduct a simulation exercise reassessing the fall in US public debt after the Second World War. They show that the fall in the US public debt-to-GDP ratio from 106% in 1946 to 23% in 1974, often attributed to high rates of economic growth, can actually be explained by primary budget surpluses, surprise inflation and financial repression. They construct the paths of the debt/GDP ratio in three counterfactual scenarios. In one, the 'primary balance scenario', they set the primary surplus to zero in all years (but leave interest rates unchanged at their historical levels). In another, the 'adjusted interest rate scenario', they eliminate the effects of both surprise inflation and the Fed's pre-1952 peg on rates, but leave primary surpluses at their historical levels. Finally, in a 'combined scenario', they assume primary balance and also adjust interest rates. The combined scenario shows how much the debt/GDP ratio was reduced by growth rates in excess of undistorted real interest rates — the decrease that reflects the economy's natural tendency to grow out of debt.

US public debt-to-GDP ratio: actual and counterfactual paths after World War II



Source: Acalin and Ball (2023)

An important message is that after US debt-to-GDP ratio rose in a few years from around 50% to over 100%, it took roughly one or two decades to get it back to its initial level through a combination of policy instruments. This is the type of path that is proposed below for the adaptive fiscal policy framework.

An analogy for climate change as a 'war-like' mobilisation

A growing strand of economic history explicitly draws lessons from Second World War mobilisation for today's climate challenge: rapid, state-coordinated reallocation; rationing of carbon-intensive inputs; price controls/standards where markets adjust too slowly; and front-loaded public borrowing to accelerate the build-out of resilient, low-carbon capital. The strategic logic is the same: delay is costlier — borrowing now to finance productive, risk-reducing assets is less risky than underinvesting and absorbing compounding losses. As in the 1940s, success hinges on credible fiscal frameworks, transparent communication with markets and institutions capable of planning and coordinating a whole-economy effort.

The other counterfactual on debt and growth is the missed opportunity (Box 4.4): the decade following the global financial crisis (2009–2019), when interest rates in advanced economies remained at or near zero. During this period, governments could have mobilised historically cheap financing to accelerate the transition, investing in resilience, clean energy and green infrastructure at minimal fiscal cost. Instead, much of this window was consumed by fiscal restraint and legacy debt concerns, leaving public investment below potential. As rates rise again, the challenge is sharper: how to reconcile debt sustainability with the imperative to scale up climate spending.

Box 4.4. A missed fiscal opportunity for financing the net-zero transition

The decade following the global financial crisis (2009–2019) was marked by historically low inflation and interest rates across most advanced economies. In many countries, nominal interest rates on public debt were close to zero — or even negative — while growth remained modest but positive. This created a highly favourable environment for public investment, including in the climate transition.

Favourable debt dynamics

In this period, the interest rate on public debt (r) was systematically lower than the nominal GDP growth rate (g). This negative $r–g$ gap meant that governments could issue debt without increasing debt-to-GDP ratios, provided that deficits remained moderate. In fact, debt could stabilise or decline over time even with ongoing borrowing, especially if it financed productive investment.

An unseized moment

Despite these conditions, most governments did not use the available fiscal space to scale up long-term investment in green infrastructure, the energy transition, or climate adaptation. Public investment as a share of GDP remained stagnant or declined in many economies. Political and institutional constraints, procyclical fiscal frameworks and fears of debt accumulation contributed to underinvestment.

Part II. Climate change-related trade-offs and challenges for fiscal frameworks

We now examine how much fiscal consolidation is actually needed to stabilise debt under textbook debt dynamics. By focusing on the interplay between growth, interest rates and primary balances, we can gauge whether traditional adjustment paths remain adequate — and what challenges are built into the current fiscal frameworks.

As described above, on average, the fiscal pressures from climate change and its social consequences amount to roughly 2–4% of GDP per year when combining disaster response, adaptation, mitigation and compensatory transfers. For countries already carrying debt levels around or above 100% of GDP, such additional burdens significantly worsen debt trajectories. Stabilising debt in this context would require primary fiscal balances to improve by at least 2–3% of GDP annually, on top of the effort needed to offset climate-related expenditures. In practice, this implies that many economies would need fiscal consolidations on the order of 4–6% of GDP simply to prevent debt ratios from rising further — an adjustment magnitude comparable to major post-crisis consolidations.

5. Magnitude of the fiscal consolidation

5.1. Simulations of climate policies with debt, GDP growth and sovereign risk premia

Facing more pressure on expenditure and limits on financing sources, fiscal frameworks will confront an inevitable trade-off: short-term risk perceptions calling for prudence and consolidation will limit fiscal space to invest in adaptation and mitigation, and will eventually reduce the likelihood of an effective transition; hence, in the medium-to-long term, climate-related risk will rise and so will risk premia. This Catch-22 situation necessitates that challenges and possible solutions be identified.

The effect of higher sovereign risk premia on debt sustainability operates through the interaction between the interest rate for government debt, the pace of GDP growth and the primary budget balance. When investors demand a higher risk premium, the effective interest rate the government pays increases. If, at the same time, GDP growth slows — due to climate damages, costly adaptation needs, or hasty fiscal consolidation — the gap between the interest rate and the growth rate widens. A larger gap means that the debt ratio will rise more quickly, even if the primary budget balance remains unchanged, because interest payments grow more quickly than the economy.

In this situation, governments need to generate larger primary surpluses just to stabilise debt levels. If both higher borrowing costs and lower growth persist, the debt-to-GDP ratio can enter a self-reinforcing upward spiral, requiring ever-greater fiscal adjustment that can be economically and politically costly to sustain.

To illustrate these challenges with a simple numerical experiment, consider a baseline fiscal scenario that is broadly consistent with current macroeconomic conditions. The public debt stock is assumed to equal to 100% of GDP, with no other stock–flow adjustments (i.e. no valuation effects, below-the-line operations, or contingent liabilities). The nominal interest rate in the baseline is set at 5% and nominal GDP growth is assumed to be 2% before climate-related shocks.

Using the estimates discussed above, we construct two adverse growth scenarios: a reduction of 1 percentage point in nominal growth to 1%, and a reduction of 2 pp to 0%, both with inflation and real growth fixed so that nominal growth changes are entirely due to the real component. Sovereign risk premia are added to the baseline interest rate in increments of +50 basis points (bps) (to 5.5%), +100 bps (6.0%), +150 bps (6.5%) and +200 bps (7.0%). The stabilisation condition is computed using the standard debt dynamics identity, in which the required primary surplus equals the interest–growth differential multiplied by the existing debt ratio. Parameters are held constant over the period, and the results indicate the primary balance (% of GDP) that would stabilise the debt-to-GDP ratio precisely at its initial 100% level under each scenario.

The primary surplus (% of GDP) required to stabilise the debt-to-GDP ratio at 100% under the above assumptions is shown in Table 5.1.

Table 5.1. Required primary surplus to stabilise debt at 100% of GDP
(Baseline: Nominal interest rate 5%, debt/GDP 100%, nominal GDP growth 2%)

Sovereign premium (in basis points)	Interest rate	Nominal GDP growth = 2% (baseline initial situation)	Nominal GDP growth = 1% (climate shock scenario 1 reducing growth)	Nominal GDP growth = 0% (climate shock scenario 2 reducing growth)
0 bps	5.0%	3.0%	4.0%	5.0%
50 bps	5.5%	3.5%	4.5%	5.5%
100 bps	6.0%	4.0%	5.0%	6.0%
150 bps	6.5%	4.5%	5.5%	6.5%
200 bps	7.0%	5.0%	6.0%	7.0%

Source: Author's calculations

Lower nominal growth and higher sovereign premia compound through the interest–growth gap. As growth falls from 2% to 1% or 0%, each extra 50 bps up to 200 bps of risk premium ratchets up the primary surplus needed to hold debt at 100% of GDP. In our baseline (i=5%, g=2%), stabilisation already requires a primary surplus near 3% of GDP. With growth at 1% and a +100 bps premium (i=6%), that rises to 5% of GDP; at 0% growth and +200 bps (i=7%), it reaches 7%. The message is simple: even modest growth disappointments combined with slightly higher borrowing costs translate into very large, persistent fiscal adjustments if the aim is strict debt stabilisation.

When one looks at the numbers, it is clear that this is politically (and operationally) implausible. Translating these percentages into today's budget scales shows why rapid adjustment is unlikely. Using estimates of 2025 GDP according to the IMF (US ≈US$30 trillion; EU ≈€21 trillion):

- Baseline stabilisation (3% of GDP): about US$900 billion in the US and €630 billion in the EU — every year.
- Mildly worse scenario (g=1%, i=6% → 5% of GDP): about US$1.5 trillion in the US and €1.05 trillion in the EU.
- Severe scenario (g=0%, i=7% → 7.00% of GDP): about US$2.1 trillion in the US and €1.47 trillion in the EU.

Taking into account that these primary surpluses would have to be achieved on top of today's fiscal deficits (roughly a 7% of GDP general government deficit in the US in 2024 and about 3.3% of GDP for the EU in 2025), the overall fiscal effort implied is of the order of 10%/12%/14% of GDP in the US and 6%/8%/10% of GDP in the EU in the baseline (3%), mildly worse (5%) and severe (7%) scenarios, respectively. These magnitudes illustrate just how politically and macroeconomically unrealistic a strategy of rapid, purely fiscal adjustment would be.

Adjustments of this magnitude would require combinations of large, immediate tax increases and/or sweeping expenditure cuts. Given current political polarisation, electoral calendars, defence-spending pressures and the need to fund climate adaptation/mitigation and social compensation, such primary surpluses are not just difficult — they are implausible to sustain. This underscores the need for a strategy that mixes credible medium-term fiscal anchors, growth-enhancing reforms (including climate investment that raises potential output), better pricing of carbon with targeted transfers and

measures that lower funding costs (e.g. climate-aligned guarantees/insurance, MDB reforms) rather than relying on abrupt consolidation that would depress growth further.

5.2. Climate challenges for fiscal frameworks

The current fiscal rules based on debt dynamics considerations, typically anchored in textbook metrics for assessing the sustainability of debt-to-GDP and fiscal deficits, face major challenges from the climate crisis (Ferdinandusse, Nerlich and Téllez, 2022). These frameworks are usually applicable and designed for a world of moderate shocks, relatively stable supply conditions and low-cost borrowing. In a hotter world with larger and persistent shocks, they are bound to become procyclical, rigid and misaligned with investment needs.

A useful insight from the recent macro-fiscal literature is how much of it now points in the same direction. Empirical work on fiscal multipliers, the very limited conditions for expansionary consolidations and the non-linear effects of debt on growth has pushed fiscal policy towards clearer anchors and more medium-term, state-contingent rules. As with the shift to inflation targeting in monetary policy, the task is no longer just to smooth cycles but to manage persistent supply shocks, now driven increasingly by climate change, while maintaining credibility.

The key challenges therefore reside in the inflexibility in response to shocks, where c**onventional rules constrain the fiscal response to climate disasters and adaptation needs.** Procyclical tightening after climate events can deepen recessions and hinder recovery. Increases in mitigation/adaption expenditures lead to higher short-term risk premia without matching with additional revenues. However, income inequality makes it virtually impossible to put any form of adequate carbon taxation and/or additional sources of revenue in place. An 'agnostic' treatment of green investment and standard accounting can treat spending according to 'golden rules', but goes no further in distinguishing between current and growth-enhancing investment (e.g. in climate resilience or clean energy).

Fiscal policy thus finds itself caught between two reinforcing pressures: the direct costs of climate impacts and the social demands they generate. On one side, more frequent disasters, persistent adaptation needs and the financing of mitigation steadily erode fiscal space and add to debt vulnerabilities. On the other, the political economy of transition — marked by rising inequality, distributive tensions and public resistance to carbon pricing or subsidy reforms — requires governments to devote additional resources to social protection and compensatory transfers. The dilemma therefore not only concerns how to mobilise sufficient resources for climate action, but also how to do so in a way that preserves social cohesion and debt sustainability, while avoiding a destabilising cycle of rising costs, deficits and discontent. In practice, rigid rules often amplify the very uncertainty that markets dislike: investors struggle to anticipate how governments will adjust when shocks collide with inflexible targets, reinforcing the perception of fiscal unpredictability.

Part III. Principles for an adaptive fiscal framework to address climate change

Given these intertwined challenges — where rigid fiscal rules risk procyclical tightening, climate shocks and adaptation needs steadily erode fiscal space and social resistance constrains revenue mobilisation — the question is, how do we design a fiscal framework that is both flexible and credible? An adaptive approach is needed that distinguishes between current spending and growth-enhancing investment, integrates climate spending into sustainability assessments and ensures that resources for mitigation, adaptation and social protection can be mobilised without undermining debt stability.

Since the Covid-19 pandemic and the geopolitical shocks of 2022–2023, macroeconomic conditions have changed markedly. Inflation surged, central banks tightened monetary policy and interest rates normalised. As a result, the *r–g* differential has reversed in many countries — especially those with higher debt or weaker credit ratings. This new environment makes the financing of large-scale public investment more fiscally costly and politically constrained.

The climate transition now faces tighter fiscal conditions, with reduced scope for debt-financed investment. The lost opportunity of the low-rate decade underscores the importance of forward-looking fiscal planning. Had climate investments been front-loaded during the low-rate period, the costs of today's transition — both economic and social — could have been lower.

Addressing climate change in an era of rising inequality and geopolitical fragmentation requires a fiscal policy framework that is both ambitious in scale and innovative in design. The challenge is to finance unprecedented levels of investment for mitigation and adaptation while maintaining fiscal sustainability and equity. This means mobilising substantially higher public spending alongside strategic participation of private finance in long-term climate investments.

Climate change and its consequences exacerbate existing inequalities, disproportionately affecting low-income households that are more exposed to physical risks and less able to afford adaptation. An adaptive fiscal policy must therefore be explicitly redistributive, ensuring that climate action does not deepen social divides. Uniform carbon taxes applied without compensation can provoke a strong public backlash, as illustrated by the *Gilets Jaunes* movement in France. To be politically viable and economically fair, climate policy must be embedded in a broad social consensus, with targeted transfers and protective measures that align environmental goals with social justice.

It is to these foundational pillars of an adaptive fiscal framework that we now turn.

6. Foundational pillars of an adaptive fiscal framework to address climate change

The fiscal response to climate change must rest on a coherent set of foundational pillars that together allow governments to break the vicious circle of climate shocks, rigid fiscal constraints and rising social pressures while preserving market confidence.

An adaptive fiscal framework integrates six mutually reinforcing principles:

1. A financing strategy that accepts the central role of public debt for large, long-lived climate investments
2. A clear separation between legacy ('old') debt and transition-related ('new') debt, enabling consolidation where appropriate without crowding out future-oriented investment; using medium-term fiscal frameworks is also important
3. Broader risk-sharing across balance sheets, leveraging multilateral, regional and private-sector instruments to reduce sovereign risk premia

4. Institutional innovation, domestically and globally, to coordinate climate-related revenues, spending and implementation
5. Regulatory reform to align financial rules and prudential standards with the risk-reducing and growth-enhancing nature of climate investment
6. Compensatory transfers and social safeguards, ensuring that the transition is equitable and politically sustainable

Taken together, these pillars define what it means for fiscal policy to become truly adaptive, and capable of supporting the climate transition at the required scale, protecting the vulnerable and maintaining long-term macro-financial stability.

6.1. Why climate policy can be financed largely through public debt

Addressing climate change requires far more than a single instrument. As Blanchard, Gollier and Tirole (2022) argue, the transition demands a portfolio of complementary policies: carbon pricing to internalise externalities, regulation to guide behaviour, public investment to overcome coordination failures and innovation subsidies to accelerate technological progress. Within this broader mix, public debt plays an essential enabling role, because many of the required interventions involve large upfront costs and long-delayed benefits.

The core economic rationale is straightforward. Climate investment generates public goods whose benefits accrue over decades in the form of avoided damages, enhanced resilience and higher productivity. Financing such long-lived investments through debt is therefore both efficient and intergenerationally fair: it aligns the timing of costs with the distribution of benefits across present and future generations. Exclusive reliance on carbon pricing or current taxation would force today's households and firms to bear the full burden of adjustment, even though much of the social return will only materialise later. Borrowing smooths these costs through time, allowing climate policies to proceed at the required scale and speed. Climate mitigation and adaptation clearly meet this criterion: failing to invest now would increase future fiscal risks through disasters, infrastructure damages, health impacts and loss of productive capacity.

Historical evidence also supports this approach. Eichengreen et al. (2021) argue that public debt, far from being an aberration or a pathology, is a recurring and often indispensable tool of state-building, war finance, crisis management and economic development. Debt only becomes dangerous when mismanaged or unsupported by strong institutions. They provide both a historical narrative and a normative defence of responsible public borrowing: public debt has repeatedly been used to finance existential priorities — wars, pandemics, reconstruction and long-term development — because private markets alone cannot deliver capital at the scale, speed or risk profile required. Properly deployed, debt has enabled states to expand capacity, build national resilience and support structural transformation. Climate investment fits this tradition: it is a forward-looking, productive use of public borrowing, and when guided by strong institutions it improves rather than jeopardises macro-financial stability.

These considerations have important implications for fiscal frameworks. **Treating climate investment as ordinary expenditure within rigid deficit or debt ceilings risks creating structural underinvestment, because these rules do not distinguish between current consumption and high-return public capital formation.** To prevent climate spending from being crowded out, fiscal rules must instead recognise its investment nature.

6.2. The case for separating old debt from new debt

The above considerations strengthen the case for dual accounting; that is, separate, transparent treatment of climate-related investment within the fiscal framework so that essential transition spending is not constrained by rules designed for routine fiscal management.

Crucially, such separation must rest on a rigorous and independently verified taxonomy of what qualifies as 'green' expenditure, distinguishing clearly between long-lived capital investment (mitigation and adaptation capex) and recurrent operational spending. Without such safeguards, a dual system risks becoming a vehicle for misclassified expenditure. With them, governments can

pursue fiscal consolidation on legacy debt in a credible manner, while ensuring that climate investment is not crowded out — nor social discontent exacerbated — by excessive austerity measures.

The core principle is the clear separation of old and new debt: the former reflecting legacy fiscal dynamics and the latter explicitly tied to climate-related policies and investments.

A closely related idea, though not framed as 'dual accounting', is advocated by Blanchard (2022) in his work on fiscal policy under low interest rates. Blanchard argues that governments should adopt 'separate accounting' for public investment and the debt used to finance it, rather than folding it into a single aggregate balance sheet. The rationale is twofold. First, investment generates long-term returns and public goods, so subjecting it to the same short-term deficit and debt constraints as current expenditure leads to chronic underinvestment. Second, placing investment and its associated borrowing within a distinct accounting envelope makes fiscal choices more transparent, allows different adjustment speeds for investment-related debt and protects productive spending from being crowded out by routine fiscal consolidation.

Extending this logic to climate investment—which is a form of public investment with exceptionally high social returns—naturally leads to a dual accounting framework: one track for legacy ('old') debt accumulated through past fiscal dynamics, and another one for new, transition-related ('green') debt tied to mitigation, adaptation and resilience. While Blanchard's proposal is general and not climate-specific, it provides the conceptual foundation for distinguishing these two debt categories so that essential climate investment is not inhibited by constraints designed for ordinary fiscal policy.

Another possible approach is the introduction of 'special' fiscal rules that exclude some climate expenditures (e.g. adaptation, mitigation) from deficit calculations. Caselli et al. (2024), however, show that there are limits to relying solely on green fiscal rules. First, green rules that exclude climate spending from deficit targets can mechanically produce large increases in deficits and public debt, undermining the credibility of the rules themselves and provoking adverse market reactions. Second, designing and calibrating such rules is intrinsically difficult: the required scale of investment, the uncertain returns of mitigation versus adaptation and long-horizon climate risks make it nearly impossible to define a stable, credible and enforceable rule. Third, identifying and classifying 'green' spending categories is subject to political contestation and technical ambiguity, while rule-based exemptions risk creating loopholes that weaken overall fiscal discipline. Their simulations that exclude green investment from deficit targets can either push debt to unsustainable trajectories or, if offset by tighter limits on the non-green fiscal balance, force governments to cut deeply into core services and social spending —skewing budget priorities in socially and politically unacceptable ways.

For these reasons, an adaptive fiscal framework requires a more structural solution than green fiscal rules alone. This is where dual accounting becomes essential. Instead of trying to stretch a single aggregate constraint to accommodate contradictory objectives, dual accounting separates old (legacy) debt from new climate-investment debt, recognising that they have different drivers, risks and macroeconomic roles. Legacy debt remains subject to credible consolidation paths and conventional fiscal discipline. Climate-investment debt, by contrast, is explicitly tied to long-term productive expenditure that enhances resilience, raises potential growth, and reduces future climate-related fiscal risks. Medium-term fiscal frameworks, discussed below, are a natural complement, allowing governments to articulate a dated trajectory for both debt categories and anchor expectations accordingly.

6.3. Risk sharing via broader balance sheets

Maintaining this balance also requires the use of broader balance sheets beyond the sovereign. Regional arrangements (such as the EU or other regional funds), international financial institutions and multilateral development banks can provide guarantees, callable capital and blended instruments that reduce the risk premium associated with climate-related borrowing. This in turn helps anchor investor confidence while lowering the cost of new debt issuance.

Another pillar of an adaptive fiscal framework is the ability to mobilise broader balance sheets beyond the sovereign, thereby reducing borrowing costs, mitigating risk premia and anchoring investor confidence. Climate investment — like defence, social infrastructure or major technological transitions

— faces large upfront costs and long payback periods. When financed exclusively at the national level, particularly in EMDEs, it is penalised by high risk premia, shallow capital markets, volatile exchange rates and limited fiscal space. Broader balance sheet mechanisms are therefore essential to spread risk across jurisdictions, institutions and asset classes.

At the regional level, the European experience illustrates the power of joint or partially joint debt issuance to reduce sovereign borrowing costs and mobilise large volumes of finance. Instruments such as NextGenerationEU (NGEU) have benefited from strong demand, low yields, long maturities and the presence of stable institutional investors, including the ECB, pension funds and sovereign wealth funds, precisely because they mutualise risk and are backed by shared fiscal capacity. A similar logic applies to climate finance globally: regional financing arrangements, joint facilities, or pooled issuance by coalitions of willing EMDEs can lower the cost of capital and attract investors whose mandates require high-quality, long-tenor instruments.

International financial institutions and MDBs play an equally critical role. Their callable capital, guarantees, and blended-finance instruments can de-risk climate investment by absorbing first-loss tranches, reducing currency exposure and lowering political-risk premia. MDB guarantees in particular are systematically underused despite their strong record in crowding in private capital, reducing funding costs and supporting bond issuance by sovereigns, sub-sovereigns and state-owned utilities. By expanding the use of portfolio guarantees, countercyclical liquidity support and local-currency facilities, MDBs can multiply sovereign and private investment while strengthening debt sustainability.

Risk sharing must also be supported by a robust and diversified financing strategy. Domestically, progressive income and wealth taxation, carbon pricing and subsidy reform remain essential, provided that they are paired with compensation mechanisms for vulnerable groups. At the international level, selective global or plurilateral instruments — financial transaction taxes, aviation and maritime levies, digital taxes and cross-border carbon mechanisms — can generate predictable and stable revenue streams. This diversification is not only a matter of efficiency; it reduces the political risks of relying on any single tax instrument and supports a credible, predictable transition path that improves market confidence.

To avoid greenwashing risks, any regional or sovereign instrument that channels funds into green uses must be aligned with recognised taxonomies and supported by independent verification. This ensures that pooled or guaranteed debt does not become a backdoor for relabelled spending, protects the credibility of regional and MDB-backed instruments and prevents mispricing in the sovereign market.

Taken together, these mechanisms show that an adaptive fiscal framework does not rely solely on national balance sheets. It uses regional, multilateral and global assets to lower borrowing costs, reduce risk premia and create fiscal space for climate investment. By redistributing risk across institutions and borders, broader balance sheet mobilisation can become a cornerstone of both fiscal stability and climate effectiveness.

Finally, because climate investment has long-lived returns, the credibility of risk-sharing arrangements must be matched by credible medium-term fiscal frameworks that articulate how green investment and its financing evolve over time. Risk sharing without predictable fiscal planning would fail to reassure markets; the combination of both is essential.

6.4. Institutional innovation

New institutions will be required to manage such revenues and policies effectively:

- **At the local level, governments need bodies with the authority and technical capacity to coordinate Ministries of Finance, Environment, Energy, Infrastructure, Social Affairs and Planning around a single climate-development strategy.** This can be done under various configurations; for instance, by establishing a cross-governmental climate and transition committee chaired by the executive branch (with the Ministry of Finance as *primus inter pares*), and/or by giving an explicit mandate, tools and staffing to the Ministry of Planning or the climate agency to arbitrate across sectoral policies, align public investment and taxation with nationally determined contributions and net-zero objectives, and negotiate with external partners (MDBs, the IMF, private investors). Without such a coordinating centre, climate spending and new

revenues from carbon pricing or solidarity levies risk being fragmented into small projects, captured by line ministries, or diverted from long-term transition priorities.

- **At the international level, the case is even stronger for an institution that does not yet exist: a Global Climate Agency (GCA), with a clear mandate to collect, pool and redistribute proceeds from global or plurilateral instruments** (carbon border adjustments, shipping and aviation levies, financial transaction taxes, fossil fuel phase-out payments, etc.), in line with equity and climate-effectiveness criteria. The current Bretton Woods set-up is not designed for that role. The IMF and World Bank were created to manage balance-of-payments crises and post-war reconstruction, not to govern a planetary stock externality with long time horizons, large uncertainties and profound distributive implications. Their core mandates are still centred on macro-stability and creditworthiness, not on enforcing a fair allocation of global mitigation and adaptation efforts. Climate has been 'mainstreamed' into their operations (until the recent reversal requested by the current US administration), but as a thematic layer on top of lending and surveillance, not as the organising principle of a global fiscal and financial architecture.

Several structural limitations follow. First, there is no institution today with the legitimacy and mandate to set common standards for climate-related fiscal instruments (carbon taxes, border adjustments, solidarity levies), prevent double taxation, leakage and arbitrage, and ensure a predictable, rules-based flow of revenues towards vulnerable countries.

Second, governance at the IMF and World Bank remains creditor-dominated; low-income and climate-vulnerable countries have a limited voice in decisions over conditionality, debt treatment, or the scale and terms of climate lending.

Third, the existing system is highly fragmented: we have excellent diagnostic and deliberative bodies (IPCC for science, UNFCCC for negotiation of NDCs) and a proliferation of vertical funds (GEF, GCF, adaptation funds, bilateral facilities), but no executive institution that can:

- Translate IPCC science and UNFCCC commitments into coherent global policy packages
- Organise a division of labour across countries and institutions
- Match NDCs and national transition plans with the right mix of grants, guarantees, concessional loans and regulatory reforms
- Monitor implementation with credible, enforceable consequences

A GCA would not replace the IMF or World Bank, but rather provide the missing 'system integrator' function. It could define common principles for climate-related taxation and levies, negotiate burden-sharing rules between advanced economies and EMDEs, act as a clearing house for global climate revenues and coordinate with Bretton Woods institutions and regional MDBs on the deployment of finance and risk-sharing instruments. In short, without a dedicated institution that treats climate as a core global public finance problem — rather than a side-constraint on traditional macroeconomic policy — the current Bretton Woods architecture will remain structurally insufficient to implement NDCs at scale, ensure equity between North and South and align capital flows with a 1.5–2°C pathway.

A frequent objection to the creation of a GCA is that such an institution will take too long to negotiate, design and operationalise — far too long given the urgency of climate change. Critics argue that building a new global body with fiscal, regulatory and redistributive authority is politically unrealistic in a fragmented world, and that efforts should instead focus on reforming existing institutions. But this argument underestimates the scale and structural nature of the climate challenge. When humanity faces truly global, systemic, and irreversible risks, incremental adjustments are rarely sufficient.

The World Health Organization (WHO)-led response to the Covid-19 pandemic offers a relevant analogy, together with a crucial caveat. On the one hand, the pandemic exposed the costs of fragmented governance: delayed border measures, lack of coordinated surveillance, uneven testing strategies, incoherent data-sharing and a recovery shaped by national rather than global priorities. It demonstrated the consequences of confronting a planetary shock without a dedicated global executive institution. Yes, despite this fragmentation, science delivered vaccines in record time. But the overall pandemic response would have been far more effective if the WHO had been equipped with

adequate resources, authority and permanent financing to coordinate surveillance, procurement, production and global distribution in a timely and equitable manner.

One modelling study from the Gates foundation estimated the cost of achieving global vaccination coverage at around US$50 billion, while the global economic losses from Covid-19 were measured in trillions of dollars. The biomedical breakthrough succeeded; the global governance framework did not. Science delivered, but institutions lagged, and the result was avoidable human, economic and geopolitical damage.

This lesson matters directly for climate policy. Climate change is far more complex than Covid-19: slower moving but vastly more destructive and pervasive, affecting energy systems, land use, infrastructure, financial markets, migration flows, food production, health and intergenerational equity. As with Covid-19, technological breakthroughs (renewables, storage, adaptation tools) are essential, but without institutions capable of organising financing, coordinating policies, ensuring equitable burden-sharing and enforcing long-term commitments, global outcomes will remain insufficient and deeply unequal.

Precisely because institutional construction takes time, work on such arrangements should begin early. Waiting until climate impacts escalate into full-scale systemic crises would make coordination harder and costlier. The lesson from other global shocks is that institutional gaps become most visible when pressures peak; addressing them gradually and pragmatically is therefore more feasible. In the face of long-lived, systemic climate risks, the benchmark for institutional design should be adequacy and effectiveness rather than convenience or path dependence.

6.5. Regulatory reform

Regulatory reform is the final pillar of an adaptive fiscal framework. Pereira da Silva (2025a) argues that most existing prudential rules were built for cyclical financial risks, not for the structural and long-horizon risks posed by climate change. Current capital and risk-weighting rules often penalise climate-aligned investment: long-tenor renewable assets, adaptation infrastructure and MDB-guaranteed operations in EMDEs frequently receive high risk weights, even though evidence shows they can be less risky than carbon-intensive assets. This misclassification raises the cost of capital, discourages cross-border flows and entrenches high risk premia in EMDEs.

An adaptive regulatory agenda must therefore adjust prudential frameworks without weakening their safeguards. Basel III's principles can remain intact, but its application must better reflect the risk-reducing role of climate investment and the risk-mitigating effect of MDB guarantees — currently underestimated by regulators and credit rating agencies. Convergence of disclosure standards and taxonomies, including International Sustainability Standards Board (ISSB) implementation and forward-looking climate stress tests, is essential to lower compliance costs and enhance investor confidence. Mobilising institutional investors also requires regulatory changes to reduce home bias, adjust solvency rules and incorporate the stabilising effects of blended finance instruments. Similarly, credit-rating methodologies need to recognise resilience assets, MDB enhancements and climate-aligned revenue streams, rather than relying exclusively on backward-looking indicators. Reforms to credit-rating practices and the expansion of foreign exchange (FX)-hedging facilities are particularly important for lowering EMDE sovereign and project-level risk premia.

Regulatory reform therefore complements the broader agenda of dual accounting, socially coherent fiscal consolidation, risk-sharing and institutional innovation. Together, these elements allow fiscal policy and financial regulation to become genuinely adaptive to the demands of the climate transition.

6.6. Compensatory transfers during the transition

Ensuring the social and political viability of the climate transition requires placing equity and redistribution at the centre of fiscal policy. Climate measures — especially carbon pricing, energy taxation and regulatory changes — often have regressive short-term effects, hitting low-income and lower-middle-income households hardest because they spend a higher share of their income on energy, food, transport and housing. Without visible, credible and well-designed compensation

mechanisms, climate policy risks eroding public trust, fuelling political backlash and ultimately slowing or reversing the transition. The experience of the *Gilets Jaunes* movement in France is a powerful reminder: even small increases in fuel taxes can trigger widespread social resistance and delegitimise longer-term climate efforts.

Compensatory transfers should therefore be understood not as an optional add-on, but as an integral component of climate macroeconomics. They can take multiple forms: lump sum rebates funded by carbon pricing revenues; targeted transfers to low-income households; support for rural and peri-urban populations disproportionately affected by mobility or heating costs; and labour market transition programmes including retraining, wage insurance and job-matching for workers in carbon-intensive sectors. Such mechanisms ensure that the transition does not worsen inequality or poverty, and that the burden of adjustment is broadly and visibly shared.

From a macroeconomic perspective, compensatory transfers also play a stabilising role. They help sustain aggregate demand during periods when climate policy may temporarily raise prices or shift relative costs. By protecting the purchasing power of vulnerable households, they can mitigate the temporary slump that sometimes accompanies the early stages of the transition — when firms adjust their capital stock and consumers face higher relative prices — thus reducing the political temptation to delay or dilute climate measures. In EMDEs, where a large share of the population is near subsistence levels, these transfers are even more crucial; without them, climate policy would risk deepening existing inequalities and undermining social cohesion.

Moreover, visible and progressive redistribution is essential to maintain the legitimacy of borrowing for climate investment. If citizens see that climate policies are fair, and that revenues or debt-financed investments produce tangible benefits for vulnerable groups, political support for long-term public investment — including via higher public debt — grows stronger. Compensatory transfers are thus not merely a social policy instrument; they are a political economy tool that underpins the credibility, durability and scale of the climate transition.

In short, adaptive fiscal policy must ensure that climate action does not exacerbate social fractures or fuel a populist backlash. Compensatory transfers — targeted, credible, transparent and linked to climate objectives — are a core stabilising mechanism, essential for social justice, macroeconomic stability and the long-term success of the transition.

Table 6.1. Foundational pillars of an adaptive fiscal framework

Pillar	Core idea	Key elements
Debt separation and fiscal credibility	Distinguish between legacy ('old') debt and climate-related ('new') debt	- Consolidate legacy debt credibly without excessive austerity that exacerbates social tension - Treat climate-related borrowing as growth-enhancing investment
Risk sharing via broader balance sheets	Use regional and international institutions to lower sovereign risk premia	- EU, regional funds, IFIs and MDBs provide guarantees, callable capital and blended instruments. - Anchors investor confidence and reduces cost of new debt.
Diversified and robust financing strategy	Mobilise revenue at domestic, regional and global levels	- Domestic: carbon taxes, subsidy reform with redistribution - International: solidarity-based levies (transactions, aviation, shipping, cross-border carbon mechanisms)

		- Innovative instruments: green bonds, state-contingent securities
Institutional innovation	Create institutions and mechanisms to pool, manage and redistribute resources effectively	- National: stronger coordination between finance and environment ministries - Global: potential Global Climate Agency to ensure equity and effectiveness in allocation
Regulatory reform	Adapt prudential and accounting rules to favour climate investment	- Recognise growth-enhancing, risk-reducing role of green investment - Adjust risk-weighting rules and accounting standards
Social equity and redistribution	Embed climate policy in a broad social contract to maintain legitimacy	- Targeted transfers to protect vulnerable households - Compensation for regressive impacts of carbon pricing (e.g. lessons from *Gilets Jaunes*) - Ensure that climate action reduces, rather than increases, inequality

A desirable fiscal framework linking the local, regional and global is described in Box 6.1. The international layer of support is especially important for low-income countries that might not have direct access to international capital markets to issue new green debt and therefore would have to rely on concessional sources of financing, including global green fiscal funds.

Box 6.1. A desirable global and local fiscal policy framework

Addressing the intertwined crises of climate change, inequality and geopolitical fragmentation requires a two-tier fiscal architecture that links international coordination with robust national action, embedded within a broader reorganisation of the global financial and governance system.

International level: a Global Climate Agency within a coordinated architecture

A dedicated GCA would pool resources, expertise and governance to ensure effective mitigation and adaptation worldwide. **Crucially, it would operate as part of a broader international climate–financial architecture, coordinating with MDBs, central banks, financial regulators, standard-setting bodies and national governments across the fiscal, monetary and prudential spheres. Subnational authorities — especially in federal systems — would be integrated through shared financing and disclosure frameworks.**

Mandate: finance climate mitigation and adaptation; provide climate risk insurance; model and disclose risks; mobilise rapid-response financing for climate damages; **support macro-fiscal scenario analysis through coordination with the IMF, World Bank, OECD, BIS and regional development banks.**

Financing: global solidarity levies on fossil fuels; a global carbon tax; an international wealth tax; national budget contributions proportional to historical and current greenhouse gas emissions; voluntary private and philanthropic contributions.

Governance: multilateral, with independent technical staff ensuring rigorous risk analysis, transparent financial management and equitable allocation of resources.

Instruments: loans and grants calibrated to development levels; integration with standard-setting bodies and credit rating agencies to revise climate risk assessment, disclosure rules, accounting standards and debt sustainability frameworks.

National level: coordinating committee or institution (Ministry of Planning) with the role of the Ministry of Finance to implement climate-compatible fiscal frameworks

Each country would need to have a stronger coordination of its policy mix (fiscal, monetary, prudential). That could be done by a new version of a Ministry of Planning, a broad Climate Policy Coordinating Agency, or any authority that would have policy responsibility and instruments. That would allow the adoption of a national fiscal framework aligned with its net-zero commitments, operationalised through a National Climate Fund for mitigation, adaptation, climate insurance, damage recovery and clean energy R&D.

Equity measures: compensatory transfers to protect low-income households from adverse effects of climate policies and provide adaptation support.

Accounting reform: distinct classification of green versus non-green debt, following the Covid-19 precedent; sovereign ratings adjusted for climate ambition and progress.

Financing: more progressive taxation, including a national wealth tax; issuance of green debt; fiscal rules adapted to permit a temporary 'investment hump' reflecting the scale of adaptation and transition spending.

This two-level system would internalise global climate externalities, protect vulnerable populations and ensure that fiscal policy becomes a central tool for building climate resilience and accelerating the transition to net zero. **Embedding the global agency within the broader international system (MDBs, central banks, regulators and national and subnational authorities) will strengthen coordination, enhance resource flows and ensure coherence across jurisdictions.**

6.7. Challenging some debt dynamics assumptions

It is possible to have a different set of assumptions for the evidence presented earlier. While most empirical studies find a negative association between public debt and GDP growth, much of that correlation likely reflects short-term market reactions — risk premia rising in downturns and around fiscal stress — rather than the long-run effects of compositionally different spending. Climate-related mitigation and adaptation outlays are predominantly public investment with supply-side multipliers, crowd-in channels (grids, resilience, R&D) and expectation effects that can raise potential growth and lower macro volatility over time. These benefits are hard to identify in market data that are dominated by near-term shocks and endogeneity (debt tends to rise in weak growth states that also lift premia). Hence, reduced-form estimates may understate the growth payoff of well-designed climate investment.

A different, perhaps more appropriate, approach is theory-consistent simulation: vary assumptions about long-run growth uplift from green investment and about sovereign premia (including their decline as resilience improves) and trace debt dynamics under state-contingent fiscal rules. Such simulations can clarify when transitional debt increases are consistent with lower risk premia and stronger growth later — something short-horizon market regressions struggle to capture.

Table 6.2. Conventional versus climate-consistent assumptions		
Dimension	Conventional evidence	Climate-consistent view
Debt–growth correlation	Most empirical studies find a negative association between high public debt and GDP growth	Much of this reflects short-term market reactions (risk premia rising in downturns and fiscal stress), not long-run effects of spending composition
Nature of spending	Evidence often treats debt as homogeneous, without distinguishing current versus investment spending	Climate-related outlays are predominantly public investment with supply-side multipliers, crowd-in effects (infrastructure, R&D, resilience) and positive expectation effects
Growth and volatility effects	Reduced-form estimates suggest that debt dampens growth, but without capturing the type of spending	Well-designed green investment can raise potential growth and reduce macro volatility over time
Limits of market data	Market data are dominated by near-term shocks and endogeneity (debt rises when growth is weak, lifting premia)	These features cause reduced-form estimates to understate the payoff of climate investment
Analytical approach	Reliance on historical correlations or short-horizon regressions	Theory-consistent simulations varying assumptions on growth uplift and sovereign premia can show when transitional debt increases are compatible with stronger growth and lower risk premia

6.8. An example of a different debt dynamic simulation

Even in the absence of such an ideal fiscal framework, and still using the current fiscal rules based on debt dynamics considerations, it is therefore possible to redo the fiscal consolidation scenarios shown above based on some alternative assumptions. The economic rationale for this stylised exercise rests on the discussion above about fiscal multipliers but most importantly the emerging literature showing that climate resilience improves country ratings and lowers sovereign risk premia (see Box 4.1). To illustrate that the climate challenges can yield different results, if responded to properly, let us perform new debt dynamics simulations assuming the same starting debt-to-GDP ratio of 100% or a higher one of 110%.

The nominal interest rate remains at 5% in the baseline, with an alternative scenario where it falls by 50 bps to 4.5% — a lower sovereign risk premium due to better market awareness of the positive effect of green investment on climate risks in the long term and on growth. Nominal GDP growth is precisely assumed to improve relative to the baseline 2% due to the positive effects of adaptation investment, which improves resilience, with two cases: +0.5 pp (2.5% nominal growth) and +1.0 pp (3.0% nominal growth). The calculations use the standard debt stabilisation condition, where the primary surplus required depends on the interest–growth differential multiplied by the debt ratio, showing how both higher growth and lower interest rates reduce the needed adjustment, but higher debt levels increase it proportionally.

Table 6.3. Required primary surplus to stabilise debt at 100% and 110% of GDP					
Scenario	**Interest rate (r)**	**Nominal GDP growth (g)**	**Debt = 100% of GDP**	**Debt = 110% of GDP**	**Difference versus baseline (with debt at 100%)**
Baseline improved growth (+0.5 pp)	5.0%	2.5%	2.5%	2.75%	-0.5%
Baseline improved growth (+1.0 pp)	5.0%	3.0%	2.0%	2.20%	-1.0%
Lower premium (-50 bps), +0.5 pp growth	4.5%	2.5%	2.0%	2.20%	-1.0%
Lower premium (-50 bps), +1.0 pp growth	4.5%	3.0%	1.5%	1.65%	-1.5%

Source: Author

The new simulations show that stronger growth from adaptation investment and lower sovereign risk premia can significantly ease fiscal pressures compared to the baseline. At 100% debt-to-GDP, the required primary surplus falls from the baseline 3% of GDP to as low as 1.5% when growth rises by 1 pp and interest rates drop by 50 bps — a reduction of half the adjustment effort. Even at a higher 110% debt ratio, these favourable conditions reduce the surplus needed to just 1.65%, still well below the baseline 100% debt requirement. These results underscore that targeted policies boosting growth and lowering borrowing costs can meaningfully improve debt sustainability, creating fiscal space for climate and development priorities. They also illustrate a simple but important feature of debt dynamics: the primary surplus required to stabilise debt rises marginally and proportionally with the debt stock when interest rates exceed growth rates.

These simulations highlight that the fiscal challenge of stabilising debt under climate risk is highly sensitive to improvements in growth and borrowing conditions (Mauderer and Stracca, 2025). Under adverse scenarios combining low growth and high risk premia, the primary surplus needed to stabilise debt can reach 5–6% of GDP — levels that are politically and economically difficult to sustain. However, with reasonable and achievable assumptions, such as growth gains of +0.5 to +1 pp from well-targeted adaptation investment and a modest reduction in sovereign risk premia, the required surplus drops dramatically to around 1.5–2% of GDP. This difference transforms debt sustainability from an almost impossible task into a manageable fiscal target, allowing space for essential climate and development spending while maintaining market confidence.

6.9. Beyond mechanical scenarios: non-linear transition dynamics

The debt dynamics simulations above — both pessimistic (in 5.1) and more optimistic (in 6.3) — are necessarily mechanical. They illustrate how debt stabilisation requirements evolve under different combinations of interest rates, growth rates and initial debt stocks. But it would be naïve to assume that the transition path will follow the smooth, linear trajectories implied by these equations. Economic transformations of this magnitude rarely proceed along steady trends. More likely, the transition will involve phases of temporary slowdown, adjustment frictions, shocks to expectations and changes in prices or profitability as climate policies (carbon pricing, regulatory shifts, sectoral restructuring) begin to bite. A short-term dip or slump before the benefits of adaptation investment and structural change materialise is entirely plausible.

This points to a deeper conceptual issue: how do we model and project a climate shock? Does it necessarily imply a negative supply shock lasting forever that lowers potential output and weakens fiscal capacity? Or can it, if met with the right policies, become a source of medium- and long-term expansion? If we assume that climate change simply reduces growth forever, the debt burden looks heavier and fiscal space narrower. **A strictly pessimistic view feeds the narrative that debt sustainability and climate action are incompatible.**

However, **the adaptive fiscal (and macroeconomic) response proposed here yields a different interpretation**. Climate mitigation and adaptation can be transformed into a Schumpeterian expansionary process, in which the transition becomes a driver of innovation, productivity, investment and employment. Massive, planned public and private investment — coupled with strong social safeguards — reduces uncertainty, raises expectations of future returns and boosts both confidence and demand. The transition, in other words, is not merely a cost to be financed; it is a strategic development opportunity that can shift the economy onto a higher long-term growth path.

Debt dynamics themselves depend critically on whether this long-run growth trajectory is strengthened or weakened. The missed opportunity of the post-2008 decade of near-zero interest rates shows that favourable financial conditions alone are insufficient if investment does not occur. Yet even in today's higher-rate environment, the challenge remains the same: to make the transition fiscally and economically viable by turning additional climate-related debt into a productive engine of long-term growth. If designed with credible institutions and predictable revenue frameworks, climate investments can help stabilise expectations, reduce macro-financial volatility and ultimately broaden the tax base, offsetting part of the initial debt increase.

In this light, the simulations should be seen not as forecasts but as boundary cases illustrating the stakes. Real-world transition paths will be more erratic than linear debt equation dynamics suggest, especially in the early phases. But if climate policy succeeds in shifting the supply side, restoring confidence and anchoring expectations, the medium- and long-term outcome can be a trajectory where growth strengthens, risk premia fall and the initial debt hump becomes manageable. The true macro-fiscal challenge, therefore, is not to avoid all additional debt, but to design climate policies that convert that debt into durable, sustainable and equitable growth.

Moreover, public debt does not become unsafe at a fixed numerical threshold, but when the expected dynamics of interest rates, growth and primary balances shift in ways that make future adjustment politically or economically impossible. Blanchard (2022) argues that debt sustainability hinges on the relationship between the interest rate and the growth rate: when $r < g$, debt can remain stable or even decline without large surpluses, making higher debt levels safer than commonly assumed. Debt primarily becomes risky when interest rates rise persistently above growth, when political institutions cannot credibly generate future primary surpluses, or when shocks (financial, geopolitical, climatic) weaken the state's capacity to refinance. High debt is not inherently dangerous; what matters is the credibility of fiscal institutions, the purpose of borrowing (productive investment versus unproductive spending) and the predictability of future policy. Blanchard emphasises that countries with strong institutions and monetary sovereignty can safely sustain much higher debt levels, whereas countries with weak credibility or exposure to sudden stops face risks even at moderate levels. The key insight is that debt only becomes unsafe when economic fundamentals and political capacity make future adjustment infeasible, not because of arbitrary numerical thresholds.

Part IV. Operationalising an adaptive fiscal framework to address climate change

The aim of this part of the report is to translate the pillars mentioned above into practical measures to break the vicious circle of climate shocks, rigid fiscal responses and rising social pressures, while preserving market confidence. Its key components are:

1. Debt separation and fiscal credibility: distinguish between legacy ('old') debt and climate-related ('new') debt; consolidate legacy debt, credibly balancing expenditures, cuts and shifts with progressive taxation and new revenues to avoid adjustment patterns that exacerbate social tensions; treat climate-related borrowing as growth-enhancing investment.

2. Risk sharing via broader balance sheets: use regional and international institutions (EU, IFIs, MDBs) to lower sovereign risk premia; provide guarantees, callable capital and blended instruments; anchor investor confidence and reduce the cost of climate-related debt issuance.

3. Diversified and robust financing strategy: mobilise revenue at the domestic, regional and global levels — domestic tools include carbon taxes and subsidy reform with redistribution, while international tools include solidarity-based levies on transactions, aviation, shipping and cross-border carbon; deploy innovative instruments such as green bonds and state-contingent securities.

4. Institutional innovation: strengthen national coordination between finance and environment ministries; create international institutions, including potentially a Global Climate Agency, to pool and redistribute revenues; ensure that allocations follow equity and climate-effectiveness principles.

5. Regulatory reform: adapt prudential and accounting rules to favour climate investment; recognise the growth-enhancing and risk-reducing role of green spending; adjust risk-weighting rules and accounting standards.

6. Social equity and redistribution: embed climate policy in a broad social contract to maintain legitimacy; protect vulnerable households through targeted transfers; compensate for the regressive impacts of carbon pricing (e.g. take lessons from the *Gilets Jaunes* episode in France); ensure that climate action reduces rather than deepens inequality.

7. Market credibility: preserving market confidence in the adaptive fiscal framework is paramount. Strengthening credibility requires that any relaxation of fiscal rules for green investment be clearly communicated, time-bound, outcome-based and reflected in credit rating agencies' debt sustainability assessments.

7. Debt separation and fiscal credibility

The Covid-19 crisis provides a useful precedent for debt separation and fiscal credibility. During that period, many governments and regional institutions (notably the EU with its NextGenerationEU facility) considered treating pandemic-related spending as exceptional, self-protecting borrowing distinct from normal fiscal operations. This separation allowed countries to mobilise extraordinary resources for health systems, income support and recovery packages without undermining market confidence in the sustainability of their 'legacy' debt.

Climate investment differs from Covid spending in duration — it is not a two-year shock — but the institutional logic is the same. When exceptional expenditures are transparently ring-fenced,

independently audited and clearly linked to productive assets, investors are willing to treat them separately from structural deficits. For climate policy, a similar approach can therefore be adopted: legacy debt would remain subject to gradual consolidation, while climate-related borrowing — clearly identified and transparently reported — would be recognised as investment in long-term resilience and growth. Just as pandemic spending was framed as a one-off emergency to safeguard society, climate investment should be framed as essential, productive and fiscally credible, preventing it from being crowded out by conventional deficit targets.

In practice, this approach amounts to a modern 'green golden rule': governments continue to consolidate the 'old' budget, while allowing the 'new' climate budget to borrow for investments with high social and economic returns. The rationale is familiar in fiscal debates. Separating a legacy budget — where adjustment, efficiency reforms and progressive revenue mobilisation continue — from a forward-looking investment budget prevents urgent climate spending from being crowded out by short-term constraints. This dual structure acknowledges that governments must, simultaneously, repair the fiscal base they inherited and build the resilience required for the future. It also provides a transparent framework for markets: consolidation remains credible on the legacy side, while climate borrowing is ring-fenced, auditable and tied to long-term productive assets.

The deeper value of the dual-budget framework lies not only in its impact on debt sustainability, but in its impact on fiscal predictability. By publishing a multi-year green budget — with clearly specified investment pipelines, expected revenues, verified KPIs and the projected contribution of green debt — governments convert an otherwise uncertain transition into a transparent fiscal plan. Markets can price a known trajectory; what they struggle to price is discretionary, ad hoc adjustment.

7.1. New debt accounting

A new debt accounting framework **can build on emerging international practice by separating legacy debt from new green and resilience debt.** Although climate investment differs from the Covid-19 shock in its duration, the pandemic provides a relevant institutional precedent: governments, parliaments and markets accepted that exceptional, time-bound, growth-enhancing spending could be ring-fenced from routine fiscal operations without undermining overall sovereign credibility. The analogy is not that climate investment is temporary, but that transparency, independent verification and clear classification allow markets to treat different forms of debt according to their economic purpose.

Under such a framework, to some extent similar to the separation advocated by Blanchard (2022), governments would publish two sets of fiscal figures in parallel:

- A core ('legacy') budget, reflecting conventional revenues, expenditures and debt
- A green budget, detailing climate-related spending, financing sources and associated green debt issuance

The same legislative scrutiny would apply to both. This separation enhances transparency, allows for targeted auditing and enables markets and rating agencies to assess the sustainability and expected returns of green investment independently from the general fiscal position. Crucially, this requires a rigorous and independently certified taxonomy that distinguishes long-lived, productive mitigation and adaptation investment (capex) from operating expenditures (opex), to avoid misclassification or greenwashing. Clear reporting and independent verification help anchor investor confidence by showing that green debt is tied to productive, growth-enhancing assets, thereby mitigating concerns about long-term fiscal risk.

Table 7.1. An example of a dual accounting framework			
Existing fiscal framework		Green fiscal framework	
Existing revenue	Existing expenditures	Green revenue	Green expenditures
Taxes	Current	Carbon taxes	Green subsidies
Social contributions	Capital	Carbon markets	Green social compensations
Non-taxes	Contingent	Green new bonds	Green investment, R&D
Grants and transfers	*Primary deficit*	Green new grants	*Primary deficit on new debt*
Financial	Interest payment		Interest payment on new debt
	Total deficit		*Total new deficit*

Source: Author

Sequencing is crucial. Initially, the green budget can be endowed with external resources, such as sovereign transfers, private contributions, or international donations, acting as a first-shock absorber. These upfront grants, potentially guaranteed by international financial institutions or by a smaller coalition of countries (a Nordhaus-type club) providing cross-guarantees, would enable the issuance of green bonds at lower cost while preserving the sovereign's credit quality. Indeed, the additional green budget can initially benefit from an endowment, from international climate grants/contributions from sovereign sources, private sources and/or foreign sources. Over time, repayment would progressively shift from reliance on exogenous resources to proceeds from newly established revenue streams, particularly carbon taxation and other climate-related levies, ensuring a sustainable and predictable long-term funding base. That would allow leveraging of these resources and lowering of the cost of the issuance of, for example, new green bonds, while preserving the credit quality of the sovereign.

7.2. Consolidation of legacy debt with social justice

The consolidation of legacy (old) debt must rest on a principled and socially legitimate approach that recognises both the macroeconomic need to stabilise debt and the political imperative to protect social cohesion.

First, stabilising legacy debt requires accepting that, where necessary, a balanced mix of expenditure rationalisation and revenue mobilisation will be needed, though confined strictly to legacy fiscal dynamics, not to climate-investment spending.

Second, any adjustment must be designed to preserve essential social spending, meaning that expenditure reviews should prioritise the phasing out of inefficient tax expenditures, environmentally harmful subsidies and low-impact programmes rather than implementing cuts to social protection, health or education. In other words, consolidation should target waste, privilege and inefficiency, not the welfare state.

Third, because fiscal consolidation has profound distributive consequences, the process must be conducted with full transparency and democratic oversight, through parliamentary debate, independent fiscal councils and clear public communication. Decisions cannot be technocratic, opaque or taken 'behind the scenes': legitimacy requires participation from elected representatives, social partners and civil society, together with accessible public information on options, trade-offs and expected impacts.

A socially just consolidation strategy is therefore not only economically sound but politically essential. Only through transparent, participatory and equitable processes can countries stabilise legacy debt without undermining trust, fairness or the broader climate transition.

One useful departing point for examining the room for manoeuvre with fiscal consolidation of legacy debt is the average picture of revenue and expenditure for OECD countries.

Table 7.2. OECD revenue and expenditure averages (2020s)

Category	OECD average (% of GDP)
Total tax/revenue to GDP	≈33.9
Social security contributions	≈8.4 (24.8% of revenue)
Personal income tax (PIT)	≈8.0 (23.6% of revenue)
VAT/goods and services taxes	≈7.0 (20.8% VAT+10.8% other consumption of revenue)
Corporate income tax	≈3.0–3.5 (varies by country)
General government spending (total)	≈42.6
Social protection (pensions, unemployment, etc.)	≈13.4
Health	≈8.4
Education	≈4.9
Public investment spending	≈3.5
Military/defence	≈1.5–2.0 (not consistently reported in OECD averages)

Source: Author, data from OECD (2024, 2025)

OECD countries collect about 34% of GDP in revenue on average, with large shares coming from social security contributions, income taxes and consumption (VAT+other consumption taxes). Public expenditure is around 42–43% of GDP, with the largest spending items being social protection (≈13–14%), health (≈8–9%), education (≈5%) and public investment (≈3.5%). The gap between revenues and expenditures suggests average deficits or a need for borrowing/fiscal balancing (depending on other non-tax revenues) of the order of 5–10% of GDP, though this will vary by country and depending on non-tax revenues or surpluses and country-specific conditions.

Against this backdrop, additional climate-related spending will add further fiscal pressure. A concrete illustration comes from the UK, where the Independent Committee on Climate Change (CCC) estimates that public spending for mitigation will average around 0.3% of GDP per year between 2025 and 2050, supporting clean power deployment, building retrofits and industrial decarbonisation. Adaptation needs are more uncertain, but recent assessments suggest that roughly £5 billion per year will be required on top of the current £9.9 billion allocated to mitigation. Even in high-income countries with strong institutional capacity, meeting climate commitments therefore implies a sustained increase in public spending, reinforcing the urgency of well-sequenced and equitable fiscal strategies.

Fiscal consolidation has been a recurrent feature of economic policy, especially in the aftermath of crises, and there is now a substantial body of research evaluating its effects. Narrative studies such as that by Guajardo et al. (2014) demonstrate that consolidation episodes are typically contractionary in the short run, with rising unemployment and lower output, challenging earlier claims of 'expansionary austerity'. Cross-country work by the IMF further shows that fiscal consolidations tend to raise inequality, particularly when they rely heavily on spending cuts; Ball et al. (2013) and Furceri et al. (2013) find that inequality and long-term unemployment often worsen when consolidations are abrupt and across the board. More recent assessments by the IMF (2023) confirm these distributional risks, emphasising the need for careful design to avoid self-defeating consolidations that undermine both growth and equity.

How can a fiscal framework address these challenges? On the expenditure cutting side, one avenue to explore is to assess the cost-effectiveness of subsidies, tax credits and transfers to firms, especially when related to fossil fuel consumption. In particular, this can be done by revisiting and reverting past policies that were evaluated as not very cost-effective. Many advanced economies have in recent years pursued fiscal strategies that shifted resources towards firms through supply-side packages, often at significant budgetary cost.

For example, in France, the Crédit d'impôt pour la compétitivité et l'emploi (CICE) aimed at reducing labour costs and improve competitiveness. First, it provided tax credits (4–6% of the wage bill) to corporates based on salaries up to 2.5 times the minimum wage (known as the Smic - *Salaire minimum interprofessionnel de croissance*). After 2018, it was transformed into a permanent reduction in employers' social security contributions. On average, the cost was between €12 and €19 billion per year from 2013–2018 up to about €20–25 billion per year after 2018. Such transfers amount annually to about 1% of GDP and contributed to higher fiscal deficits. The CICE had mixed results (France Stratégie, 2020; Cour des comptes, 2017), with some positive employment and salary benefits in certain sectors, particularly services, but limited effects on investment and industry employment.

Similar policies can be observed elsewhere: in the UK, successive cuts to the main corporation tax rate from 28% in 2010 to 19% in 2017, alongside new reliefs such as the patent box, represented sizeable revenue losses, even if partially offset by a broader base and profit recovery. In Germany and other EU countries, reductions in employer social contributions and investment incentives have likewise been deployed in the name of competitiveness. In the US, recent fiscal policy has channelled very large resources towards firms through supply-side tax cuts and subsidies. The 2017 Tax Cuts and Jobs Act (TCJA) stands out; it reduced the federal corporate income tax rate from ranges of 15% to as high as 39% to a flat 21% and introduced accelerated depreciation and other firm-oriented incentives. The Congressional Budget Office estimated that the TCJA would increase federal deficits by about US$1.5 trillion over 10 years, roughly 0.7% of GDP per year, with the corporate tax cut alone representing one of the most expensive components. Evaluations by the US Treasury and independent academic analyses found modest investment effects relative to its fiscal cost, with much of the gain accruing to higher dividends and share buybacks rather than new productive investment

Therefore, while the precise magnitudes vary by country, these examples show that several points of GDP have recently been mobilised to support firms through tax credits and contribution cuts, often with limited effectiveness and without adequate targeting, highlighting that, in principle, similar fiscal room could be redirected or reprioritised towards fiscal consolidation of legacy debt, climate investment and social cohesion rather than generalised corporate relief.

On the revenue side, in *Inequality: What Can Be Done?* (2015), Anthony Atkinson put forward a comprehensive set of 15 proposals to tackle inequality in advanced economies that can be applied to the issue at hand. What distinguishes his agenda is its dual ambition: the very instruments designed to enhance redistribution can also reinforce fiscal consolidation, helping governments reduce legacy public debt while advancing equity. Atkinson's proposals span employment and pay policies, capital and wealth redistribution, tax and transfer reforms and social protection. They are carefully designed to combine fairness with fiscal responsibility — for instance, pairing new transfers with dedicated revenue sources, broadening the tax base and strengthening automatic stabilisers. In UK simulations, such measures not only reduced post-tax inequality by about one-third but also increased revenues by several pp of GDP. Atkinson's central message is that redistribution and consolidation are not opposing goals. With the right design, progressive policies can simultaneously improve social outcomes and debt sustainability (see Box 7.1).

Box 7.1. Atkinson's proposals: redistribution with fiscal consolidation potential

In *Inequality: What Can Be Done?* (2015), Anthony Atkinson advanced 15 concrete proposals to reduce inequality in advanced economies. Although not developed with climate policy in mind, his agenda is highly relevant for today's fiscal landscape. Many of the instruments he proposes simultaneously improve redistribution and strengthen the fiscal capacity needed for climate mitigation and adaptation. In other words, policies that reduce inequality can also support the

socially just consolidation of legacy debt and expand the revenue space required for green investment.

Employment and pay policies

Atkinson proposed:

1. Guiding technological change to promote jobs and services with high social value
2. Strengthening collective bargaining and social partnership institutions
3. A public job guarantee at the minimum wage
4. A statutory minimum wage linked to a living wage

While these measures imply higher public outlays in recessions, they raise revenues over the cycle by supporting employment and the tax base.

Capital and wealth

Atkinson called for:

5. Guaranteed-return national savings bonds for small savers
6. A universal capital endowment (e.g. £10,000 at age 18 in the UK)
7. A publicly owned investment authority financed through a reformed capital receipts tax, designed as a vehicle to manage long-term public investment

The capital endowment was explicitly to be financed by a progressive lifetime capital receipts tax, replacing traditional inheritance tax.

Tax and transfer system

Atkinson argued for:

8. More progressive income tax with a top marginal rate up to 65%
9. An earned income discount to reduce tax liability for low wages
10. A progressive lifetime capital receipts tax as above
11. A proportional/progressive property tax based on current valuations

Together, these reforms would significantly boost fiscal revenues while shifting the burden towards the top of the distribution. UK Treasury simulations at the time indicated that moving the top marginal income tax rate from 45% to 65% could raise several billion pounds annually, even after behavioural responses.

Social protection

Atkinson also proposed:

12. Universal child benefits at a substantial level, taxable as income
13. A participation income (a conditional form of basic income linked to work, care or community activity)
14. Stronger social insurance with higher benefit levels and wider coverage

These entail spending, but their design strengthens automatic stabilisers, meaning higher revenues in booms and stronger cushioning in recessions.

Finally, Atkinson urged that:

15. Advanced economies raise official development assistance (ODA) to 1% of gross national income (GNI)

Several of Atkinson's measures expand fiscal space in ways that are directly relevant to climate policy: they raise progressive revenues, strengthen automatic stabilisers and reduce inequality, lowering the political resistance that often derails climate taxation or carbon pricing reforms.

Fiscal implications

- Several proposals are self-financing pairs: the capital endowment funded by a capital receipts tax; child benefit partly clawed back through taxation; public employment offset by lower unemployment benefits and higher revenues.
- Others expand revenue capacity: higher top income tax rates, property taxes and a sovereign wealth fund.
- The emphasis on progressivity ensures that fiscal balances improve during expansions: in UK calibrations, post-tax inequality could be reduced by around one-third relative to market incomes, while revenues would rise by several pp of GDP.

Conclusion

Atkinson's package demonstrates that redistribution and fiscal consolidation are not contradictory. **For climate policy, the relevance is twofold.** First, progressive tax instruments and strengthened automatic stabilisers can generate part of the additional revenues required for mitigation and adaptation while protecting low- and middle-income households. Second, by reducing inequality and enhancing social insurance, these measures increase the political durability of climate policies — particularly carbon pricing and subsidy reforms that otherwise risk triggering a social backlash. Well-designed redistribution is therefore not only compatible with climate-related fiscal consolidation; it is essential in making it work.

There are, indeed, episodes where governments have sought to consolidate with greater concern for social justice. Iceland's adjustment after the 2008 financial crisis is a notable example. Within an IMF-supported programme, the authorities explicitly aimed to safeguard the welfare system, relying on progressive tax increases and targeted cuts rather than broad reductions in social transfers. Capital controls also provided breathing space to stabilise the adjustment.

The Nordic consolidations of the 1990s, particularly Sweden's, similarly illustrate how multi-year, phased strategies combining structural tax reform with selective expenditure restraint can preserve the social contract while restoring fiscal balance. What distinguishes these episodes is composition: targeted measures to protect low-income households, reprioritisation of spending to maintain essential services and greater reliance on progressive revenues. IMF and OECD guidance echoes these lessons, underscoring that well-designed consolidations should prioritise timing, targeting and composition rather than blunt expenditure reductions.

A further strand of the debate emphasises the role of new progressive taxes as part of fiscal consolidation strategies. Recent proposals, notably those advanced by Zucman for the G20, suggest a global minimum tax on billionaires of around 2%, which could raise an estimated US$242 billion annually if enforced effectively. The EU Tax Observatory has provided concrete blueprints for how such taxes could be coordinated internationally, drawing on mechanisms such as 'tax collector of last resort' provisions and exit taxes to reduce avoidance (Zucman, 2024). More broadly, IMF country guidance now highlights equity-enhancing revenue measures such as improved top-rate personal income taxes, strengthened property and inheritance taxes, and targeted excises as key complements to spending-side reforms.

Three distinct tax options have been put forward to strengthen both fiscal capacity and redistribution in OECD countries: a Zucman-style minimum wealth tax on billionaires (and potentially on individuals with more than US$100 million in assets), a French-style impôt de solidarité sur la fortune (ISF) applied to households with net wealth above a fixed threshold and a return to post-war progressive income taxation with top marginal rates around 65%, as advocated by Atkinson (2015). These instruments differ sharply in scale, coverage and yield.

A Zucman-type minimum tax would only concern a few thousand billionaires in the OECD — several tens of thousands if the threshold is lowered to US$100 million — but could nonetheless generate around 0.25% of GDP annually, making it highly concentrated in incidence but powerful in both symbolism and revenue per taxpayer.

The ISF-type net wealth tax, by contrast, would fall on several million households, about 2–3% of the population, and yield a more modest 0.1–0.3% of GDP, reflecting its broader but shallower base.

Re-establishing a post-war progressive income tax regime with a 65% top bracket would affect the top 1–2% of earners — roughly 10–20 million people across the OECD — and provide the largest and most durable revenue gain, in the order of 0.8–1.5% of GDP. Indeed, using realistic assumptions about the income share of the top 1–2% (around 15% of GDP in many OECD countries) and allowing for behavioural responses, restoring this post-war-style tax regime would increase the effective average tax rate on this group by perhaps 6–10 pp. Applied to this income base, this yields additional revenue of roughly 0.9–1.5% of GDP. These back-of-the-envelope estimates are consistent with the historical evidence and with theoretical work on revenue-maximising top rates, and suggest that a reformed progressive income tax could by itself provide on the order of 1 pp of GDP in durable revenue in advanced economies with the advantage of being a sovereign decision by any single state willing to undergo a fiscal consolidation of its legacy debt.

Taken together, the three options are complementary: the minimum wealth tax targets extreme concentrations of fortune; the ISF extends taxation to the wider wealthy class; and the high-rate income tax secures steady revenue from top earners. In combination, they could raise 1.5–2% of GDP in sustainable additional revenues while reinforcing the redistributive impact of the tax system.

Table 7.3. Revenue and coverage of three inequality-reducing tax options in OECD countries

Instrument	Core design (reference)	Illustrative OECD revenue (% of GDP)	Estimated people concerned (OECD)	Redistributive effect	Feasibility/notes
Zucman-type minimum wealth tax	2% minimum tax on billionaires' net wealth; optional extension to ≥US$100m	0.20–0.35 (billionaires); 0.35–0.55 if extended	~3,000–3,500 billionaires worldwide, 60–70% in OECD (~2,000–2,500). With ≥US$100m: ~20–25,000 individuals	Very concentrated; high yield per person; targets the ultra-wealthy	Feasible if coordinated internationally (registries, exit tax)
French ISF-type net wealth tax	Progressive tax on net wealth above ~€1.3m, rates up to ~1–1.5%	0.10–0.30	~2–3% of households; ~350,000 taxpayers in France; scaled OECD: ~3–5 million households	Broader incidence; upper-middle-class and wealthy; visible fairness	Modest revenue; avoidance if exemptions remain
Post-Second World War personal income tax (65% top bracket)	Restores 65% top marginal income tax with broad base and curbed shelters	0.8–1.5	Top 1–2% of earners (~10–20 million people across OECD)	Largest sustained yield; reduces post-tax top income share	Politically sensitive; requires anti-avoidance and capital–labour alignment

Source: produced by author using Zucman (2024), Atkinson (2015)

In addition to new instruments, many OECD countries can strengthen and modernise existing tax bases, for example by reducing property tax exemptions, improving valuation systems, tightening rules on capital income taxation, closing inheritance tax loopholes and enhancing enforcement through digitalisation. These reforms are less costly to administer than launching entirely new taxes and can generate steady, politically robust revenues that support equitable consolidation.

In sum, historical experience suggests that equitable consolidation packages typically reduce fiscal deficits by about 3–5% of GDP over several years, and can do so in a way that preserves social cohesion when measures are carefully targeted, phased and supported by progressive revenue mobilisation. This demonstrates that consolidation of legacy debt with social justice is feasible, and can even create the fiscal space necessary for some climate and social investments.

7.3. Consolidation of legacy debt with multi-year spending rationalisation

Finally, fiscal consolidation can also involve reviewing the efficiency of public spending, scrutinising existing expenditures, benchmarking efficiency and identifying low-value programmes. This allows governments to cut or rationalise expenditure in a structured way, safeguarding growth- and equity-enhancing investments while meeting fiscal consolidation needs.

The French experience with budget programmes and the Rationalisation des Choix Budgétaires

A further illustration of expenditure rationalisation comes from France's efforts to structure the budget around multi-year programmes. Beginning in the late 1960s, the Rationalisation des Choix Budgétaires (RCB) sought to move beyond incremental budgeting by introducing systematic programme reviews, performance criteria and cost–benefit analysis into the allocation of public resources. Inspired by the US planning–programming–budgeting system (PPBS), the RCB aimed to ensure that expenditure decisions were guided by clear objectives, measurable results and long-term priorities rather than short-term political pressures.

The RCB was closely tied to the post-war tradition of economic planning in France, embodied in the Commissariat général du Plan and a network of planning institutions that promoted coordinated, forward-looking resource allocation. The ambition was to embed budgetary choices within a broader planning horizon, linking medium-term economic strategies with annual fiscal decisions. This reflected a belief that efficiency in public expenditure could not be separated from a coherent vision of national development and structural transformation.

Although the RCB itself was gradually abandoned in the early 1980s due to its technical complexity and limited political traction, it left an important legacy — the idea that budgets should be structured around missions and programmes, with explicit performance goals. This principle was revived and institutionalised through the 2001 Organic Budget Law (LOLF), which redefined the French budget architecture into missions and programmes with multi-year perspectives and performance indicators.

The French experience thus highlights both the potential and the challenges of programme-based, multi-year expenditure rationalisation. On the one hand, it can enhance transparency, discipline and strategic allocation of resources, helping governments safeguard priority investments while consolidating public finances. On the other, it requires strong political ownership, administrative capacity and credible performance measurement systems to avoid degenerating into a formalistic exercise.

Beyond the French case, many countries have developed systematic tools to assess spending efficiency and identify areas where resources can be reallocated without undermining social goals. These instruments are increasingly essential for equity-preserving consolidation strategies, as they allow governments to prioritise high-impact programmes while phasing out low-value spending. Box 7.2 summarises the main approaches, such as public expenditure reviews (PERs), spending reviews and performance audits, that can support a structured, evidence-based rationalisation process.

Box 7.2. Reviewing the efficiency of public expenditure

Public expenditure reviews

Definition: PERs are systematic assessments of how public resources are allocated, spent and managed. They aim to evaluate the efficiency, equity and effectiveness of government programmes.

Fiscal policy can use PERs to:

- Identify low-priority or underperforming programmes where funds can be cut or reallocated without major social costs
- Benchmark spending against international or peer-country comparators (e.g. health and education spending per student, hospital efficiency, administrative overheads)
- Detect overlaps or duplication across ministries or programmes (e.g. multiple small social transfers that could be consolidated)
- Highlight areas where value for money is weak (e.g. subsidies with low impact, ineffective tax expenditures)

Spending reviews/expenditure rationalisation exercises

Regular spending reviews: many governments (the UK, the Netherlands, France, etc.) institutionalise periodic reviews to set expenditure ceilings and identify savings.

Techniques include:

- **Baseline expenditure analysis:** projecting the costs of maintaining current policies and then identifying which 'baseline' items can be reduced
- **Zero-based budgeting (ZBB):** instead of incrementally adjusting previous budgets, each programme must justify its existence from scratch
- **Functional reviews:** examining whether government should still be carrying out certain activities (privatisation, decentralisation, outsourcing)

Mechanisms to strengthen expenditure efficiency

- **Performance audits (by supreme audit institutions):** assessing whether funds achieve intended outcomes; these can uncover waste and inefficiency
- **Public investment management assessments (PIMAs):** examining capital spending efficiency and avoiding white elephant projects
- **Programme evaluations/cost–benefit analysis:** quantifying social returns relative to fiscal costs
- **Spending benchmarks and unit costs:** comparing the unit costs of services (e.g. cost per hospital bed, cost per kilometre of road maintenance) across regions or over time

Planning cuts and rationalising spending

- **Prioritisation frameworks:** establishing criteria (growth impact, social equity, resilience) to decide where to cut or maintain spending
- **Phasing out regressive or inefficient subsidies:** especially fuel, energy, or agricultural subsidies with limited social returns
- **Consolidating small programmes:** reducing administrative overheads by merging schemes
- **Targeting social programmes more effectively:** using means testing, digital platforms, or conditionality to reduce leakage and improve impact

- **Medium-term expenditure frameworks (MTEFs):** linking reviews with multi-year fiscal planning and ensuring that identified savings are embedded in future budgets

Institutional and political dimensions

- **Whole-of-government approach:** PERs often require inter-ministerial coordination and political backing
- **Transparency and communication:** publishing results builds legitimacy and helps manage resistance to spending cuts
- **Link to fiscal rules and consolidation targets:** efficiency gains and rationalisation help meet deficit or debt-reduction paths without undermining core public services

Government internal audit systems

These also play an important role by checking compliance and financial integrity within ministries and agencies, ensuring that budgeted funds are used as intended and helping to prevent misuse before it escalates. External audit bodies such as the **Cour des comptes** in France or the **Tribunal de Contas da União** (TCU) in Brazil provide independent scrutiny of accounts and programme outcomes, issue public reports on spending efficiency and make recommendations for rationalisation and savings. Their authority and transparency help reinforce the credibility of expenditure reviews and strengthen public trust in consolidation efforts.

7.4. Reform of debt sustainability analysis: new stochastic climate-adjusted debt sustainability assessments

While debt-to-GDP ratios remain a central metric for fiscal credibility, the longer-term dynamic path of debt matters more than its static or short-term level. Green investment — especially in adaptation, mitigation infrastructure and energy transition — may temporarily increase debt ratios but can raise potential growth, improve resilience and reduce future liabilities. This implies the possibility of a transitional hump in debt-to-GDP ratios, which may be justified if it leads to higher long-term GDP and lower climate-related fiscal risks. Ministries of Finance must balance this short-long term trade-off when monitoring the trajectory of debt sustainability, while differentiating productive, forward-looking investment from recurrent spending. Improved green public investment appraisal tools and climate-growth modelling are needed to justify such medium-term deviations from debt targets.

Relatedly, while pre-committing revenues from carbon pricing, subsidy reform or solidarity levies can be an effective way to create predictable funding for climate investment, Ministries of Finance often view earmarking as limiting fiscal flexibility. This concern is valid. Yet experience shows that well-designed, partial or time-bound pre-commitments can strengthen fiscal credibility by assuring markets and citizens that climate revenues will be used as intended. In the context of climate investment, the purpose of pre-committing revenues is the creation of stable, medium-term financing anchors that lower risk premia, support investment planning and ultimately reinforce long-term debt sustainability.

There is a need to promote coordinated international reform of the DSA frameworks, in collaboration with the IMF, World Bank and BIS. The reformed approach should explicitly integrate climate-related fiscal risks (both physical and transition), scenario analysis for mitigation/adaptation investments and the long-term growth benefits of resilience spending. This would ensure that DSAs do not penalise proactive climate investment and that debt sustainability assessments reflect the reality of climate-adjusted fiscal trajectories.

Reforming DSA frameworks for a climate-constrained world requires going well beyond small technical tweaks. The core change is conceptual: from a short-horizon, deterministic, 'level-of-debt' view to a long-horizon, stochastic, climate-adjusted view of sustainability. The current IMF–World Bank frameworks for market-access countries (the SRDSF) have already introduced useful innovations — fan

charts, probabilistic tools and stress tests — but still mostly work with a 10-year horizon built around standard macro shocks and conventional fiscal reactions.

Climate change fundamentally challenges this setup: most material physical and transition risks, as well as the benefits of climate investment, unfold over 20–30 years, not in a 5-year programme window. Zenios (2021) shows that when climate damages are integrated using integrated assessment models (IAMs), climate-adjusted debt paths only tilt upwards after 2030–2050, and risk fan charts widen markedly over time. If the horizon is too short, these risks — and the stabilising effects of early adaptation and mitigation — simply do not appear in the analysis.

A reformed DSA would standardise longer horizons (e.g. 20 years) and explicitly embed climate scenarios. Several proposals are now converging on this point. Guzman et al. (2023) from the Boston University GDP Center call for the IMF and World Bank to make 20-year horizons standard practice in DSAs so that both the costs of climate impacts and the benefits of climate investment are captured. A climate-adjusted DSA would instead use NGFS-type climate scenarios, integrated assessment model (IAM)-consistent damage functions and explicit modelling of adaptation to generate forward-looking primary-balance, growth and interest-rate paths under different policy choices.

More importantly, DSA needs to become explicitly stochastic, not just in the generic macro sense but with climate-specific uncertainty. This approach needs to be extended to incorporate climate-related fat-tail risks (extreme events, tipping points, regime shifts in risk premia) and transition shocks (e.g. abrupt changes in carbon prices, stranded assets, trade measures). Rather than a single deterministic baseline plus a few ad hoc adverse scenarios, climate-adjusted DSA should present probability distributions of debt that are conditional on climate and policy pathways, making both the downside risk and the upside potential from successful adaptation and green growth explicit.

Then, a reformed DSA must distinguish the composition and use of debt, not only its aggregate level. Current frameworks still treat all borrowing largely symmetrically: debt incurred to roll over old liabilities, to finance current spending, or to fund high-return climate investment all enter the arithmetic in the same way. A climate-adjusted DSA should be built around a dual lens: a 'legacy' component, reflecting past fiscal choices and conventional risks, and a 'green/resilience' component, explicitly tied to climate-related investment and reforms.

DSA would then assess whether green borrowing raises long-run growth or reduces climate-related fiscal risks sufficiently to justify a temporary debt hump. This is exactly what long-horizon climate-adjusted debt simulations for European countries already suggest; allowing for higher investment and growth produces different, often more benign, debt trajectories than simple extrapolation of past trends. In such a framework, the key question is not "What is the debt ratio next year?" but "Given the climate pathway and investment strategy, is the probability of distress over 15–20 years compatible with sustained climate action and macro stability?"

Finally, climate-adjusted DSA needs to be anchored in a broader macro-financial narrative. It should integrate:

- Forward-looking estimates of climate damages and adaptation needs
- The growth effects of green public and private investment
- Feedback loops between climate shocks, sovereign spreads and market access
- The role of multilateral risk-sharing (e.g. guarantees, concessional windows) in bending the debt path

Current DSAs are not compatible with ambitious action on climate and nature, and without such reforms they tend to over-penalise climate investment and underweight the risks of inaction. A climate-adjusted DSA would reverse this bias. By extending the horizon, embracing stochastic, scenario-based analysis, and distinguishing between legacy and climate-related debt, it would provide Ministries of Finance and the IMF with a more realistic picture of sustainability in a hotter world — one that recognises both the risks of climate shocks and the growth-enhancing, risk-reducing potential of timely climate investment.

8. Risk sharing via broader balance sheets

8.1. Regional and global budgetary arrangements

In this dual-accounting framework, the green budget could also be financed through dedicated and diversified instruments tailored to the unique nature of climate investment. First, governments can issue green bonds, explicitly earmarked for mitigation and adaptation expenditures, aligned with recognised standards. These labels allow investors to trace the use and impact of funds and help differentiate green investment from recurrent spending. However, sovereign green bonds also carry a well-documented risk of greenwashing, whereby existing expenditure could be relabelled to create apparent fiscal space. To preserve credibility, strict taxonomy alignment and independent verification are essential. Fiscal councils, audit institutions, or designated green investment boards should certify eligible projects ex ante and conduct ex post audits of implementation and impact.

Second, financing could also come from regional mechanisms or special-purpose balance sheets, such as a climate-focused issuance of Eurobonds backed by a coalition of willing eurozone countries; an approach that could be replicated in other regions, for example through a coordinated ASEAN green facility.

Third, as geopolitical conditions evolve and global cooperation strengthens, a global climate transition fund (e.g. expanding the Nations Framework Convention on Climate Change's (UNFCCC's) Green Climate Fund) could be strengthened to pool resources from developed and emerging economies alike, offering concessional or blended financing to support national green budgets.

These instruments would collectively reduce pressure on fiscal accounts, ensure targeted deployment of resources and send a strong market signal that the climate transition is being financed in a disciplined, credible and internationally coordinated manner. Eventually, such global funds could be endowed with permanent sources of financing, including global solidarity levies (on fossil fuel extraction, aviation, shipping, or methane emissions) and harmonised border-adjusted carbon charge on high-emission goods.

8.2. Leveraging multilateral development banks balance sheets, guarantees and pooled issuance

Mobilising sufficient finance for the climate transition in EMDEs requires going beyond traditional sovereign borrowing. Fiscal space in many of these countries is already constrained, with debt ratios elevated and borrowing costs rising. As Pereira da Silva (2025b) emphasises, unlocking climate capital is critically dependent on leveraging the balance sheets of MDBs and other international financial institutions to reduce risk premia and attract private investors.

One central mechanism is the strategic use of guarantees and callable capital. MDBs can provide partial credit guarantees or political risk insurance that de-risk green investments, making them attractive for institutional investors such as pension funds or sovereign wealth funds. Because MDBs benefit from preferred creditor status and diversified portfolios, they can absorb risks more efficiently than individual sovereigns. This allows fiscal authorities in EMDEs to tap private markets at lower cost without adding unsustainable pressure to public budgets.

Another avenue, highlighted by Pereira da Silva (2025b) is pooled or joint issuance of debt, akin to the EU's NextGenerationEU programme or recent proposals such as the Draghi report for European climate bonds. By mutualising risks across countries or institutions, such arrangements can lower borrowing costs while preserving fiscal credibility. For EMDEs, regional pooling mechanisms, backed by MDB guarantees, could enable access to large-scale, long-tenor financing that would otherwise be unavailable on affordable terms.

Further, MDBs can act as catalysts for crowding in private finance. By blending concessional capital with market-rate investment, structuring green bonds with AAA tranches, or providing FX facilities for long-dated projects, they can create investable pipelines in sectors such as renewable energy, resilient infrastructure and sustainable agriculture. In doing so, MDB balance sheets extend the reach of

scarce public funds, allowing fiscal policy to focus on core social spending while private capital finances much of the transition investment.

In sum, risk-sharing mechanisms anchored in MDB balance sheets and guarantees are indispensable. They allow climate-related investment to be recognised not as an additional fiscal burden, but as a catalyst for growth and resilience that can be financed in partnership with global capital markets.

Finally, it is also important to consider that while guarantees and pooled balance sheet approaches play a central role, countries can also rely on complementary instruments that do not require significant upfront public spending. Targeted fiscal policies (such as feed-in tariffs, contracts-for-difference, or other long-term price commitments) can create predictable revenue streams that materially lower project risk premia. These tools often attract private capital without the need for guarantees or direct sovereign lending, while their fiscal implications are spread over time and can be managed transparently within medium-term frameworks.

In addition, SOEs and dedicated public financial vehicles can support investment using their own balance sheets, particularly when they benefit from preferential borrowing terms or concessional co-financing. When governed well, these entities can crowd in private investors at scale and act as part of a broader 'green investor state' (Beck and Larsen, 2024), reducing pressure on the central government's headline balance sheet. Together, these complementary measures broaden the menu of risk-sharing tools available to governments and strengthen the overall reform package.

9. Diversified and robust financing strategy

To finance the rising fiscal demands of the climate transition, governments must explore a diversified set of revenue-enhancing instruments, both domestic and international. At the national level, options include the introduction or strengthening of carbon pricing mechanisms such as carbon taxes or emissions trading systems, which not only raise revenue but also serve as key mitigation tools. Broader tax reforms can enhance revenue mobilisation while promoting equity, for example removing fossil fuel subsidies, increasing environmental levies and improving the progressivity and efficiency of tax systems. Internationally, collective initiatives could generate new streams of revenue through global solidarity levies, including taxes on international aviation and shipping, a financial transaction tax, or even coordinated carbon border adjustments. Over time, more ambitious proposals such as a global wealth tax or sectoral digital levies could also play a role.

These instruments should be designed to be politically acceptable, administratively feasible and transparently earmarked for green investment or redistribution. Importantly, such efforts require international coordination to reduce tax competition and ensure fairness, while building credibility with markets and constituencies.

9.1. Financing mitigation and adaptation

Financing these policies requires a permanent shift towards more progressive, climate-aligned fiscal systems, supported by credible international cooperation:

- Progressive income taxation: higher marginal rates on top-income groups (see Atkinson's proposals in Box 7.1), reflecting the strong correlation between income levels and carbon footprints.
- Wealth taxation: targeted levies on large net worth to finance climate and resilience investments, justified by intergenerational equity and the global public-good nature of climate stability.
- Targeted and compensated carbon taxation: gradual introduction or expansion of carbon pricing, with revenues partly recycled to protect low-income households and businesses from regressive effects, using Emissions Trading Scheme (ETS) benchmarks for price signals. To meet the growing fiscal needs of climate mitigation, adaptation and just transition measures, governments can mobilise additional revenues equivalent to an estimated 2–4% of GDP over time through a combination of national and international instruments. Domestically, a well-

calibrated carbon tax — starting at US$50–100 per tonne of CO_2 and gradually increasing — could raise 1–2% of GDP annually in many middle- and high-income economies, while also reinforcing emission reduction goals. Complementary reforms such as the phase-out of fossil fuel subsidies (which globally amount to over 6.5% of GDP according to the IMF), environmental excise taxes and closure of VAT and corporate tax loopholes could yield an additional 0.5–1% of GDP.

- **International climate solidarity levies**: global-scale taxes — for example on fossil fuel exports, aviation, shipping, or financial transactions — negotiated through multilateral agreements to finance adaptation and mitigation in developing countries. Internationally coordinated mechanisms such as a financial transaction tax (e.g. 0.1% on equities and 0.01% on derivatives) could generate up to 0.3–0.5% of global GDP, while a global aviation levy (US$10–30 per ticket) or maritime fuel tax could each raise approximately 0.1–0.2% of GDP if adopted by G20 countries. Over time, more ambitious tools, such as a modest global wealth tax (e.g. 1% on ultra-high-net-worth — >US$50 million — individuals), could yield an additional 0.5–1% of global GDP. The effective mobilisation of these revenues will depend on political feasibility, administrative capacity and multilateral cooperation, but collectively, they could provide a critical, diversified and progressive source of fiscal space to support adaptive climate investment without jeopardising debt sustainability.

- **Innovative debt instruments**: issuance of green and resilience bonds, alongside a temporary separation of accounts to finance the transitional expenditure hump — an approach akin to wartime financing for a 'climate war'.

This adaptive fiscal framework acknowledges that climate change is a structural, long-term macroeconomic shock. The policy response must therefore combine decades-long investment commitments with fiscal designs that preserve equity, incentivise private participation and maintain debt sustainability over the long horizon required for the net-zero transition.

9.2 Enhance the sovereign green bond market, take advantage of the greenium

Innovative green bonds do not represent a 'debt sustainability' policy proposal in the macroeconomic sense, but rather a specific debt sustainability–related measure for sub-investment-grade sovereigns. This instrument can be used even more forcefully for developed countries.

- Use MDB credit enhancement through guarantees or equity stakes in a structured finance SPV to uplift the sovereign's green bond rating from below investment grade to investment grade.

- This 'rating uplift' would reduce spreads (e.g. going from BB to BBB could cut ~200 bps in funding costs), making debt servicing more sustainable and enabling larger, repeat issuances for climate investment.

- MDB support should be designed to keep the uplift cost low for the issuer and aligned with the MDB's capital constraints, using diversified exposure and possibly committed anchor investors, such as central banks.

- The approach is framed as a way to improve market access and lower financing costs for the transition to net zero, thereby indirectly strengthening debt sustainability for these countries.

The greenium: a structural shift in financing conditions

There is mounting evidence of a *greenium* — a yield discount on green bonds relative to equivalent conventional bonds — driven by investor demand, environmental social and governance (ESG) mandates and portfolio constraints (Hachenberg and Schiereck, 2018).

The size of the greenium varies by issuer type and region (typically 5–20 basis points for sovereigns), but is growing with increased demand for green assets. To reliably capture a greenium, governments must:

- Clearly label and verify green expenditures
- Align with recognised taxonomies (e.g. ICMA, EU GBS)
- Publish ex ante frameworks and ex post impact reports
- Ensure independent oversight to avoid greenwashing, which can eliminate the yield advantage altogether

9.3. Debt-for-climate and green debt swap mechanisms

Beyond green bond issuance, debt-for-climate swaps are gaining traction. Existing high-cost or short-duration debt can be exchanged for long-term concessional or guaranteed green instruments. This was pioneered in Seychelles, Belize and Barbados, with support from non-governmental organisations (NGOs) and development finance institutions. Swaps reduce debt service pressure and create fiscal space for verified green investment. MDBs and bilateral donors can catalyse these operations via partial guarantees, credit enhancements and green performance-linked instruments.

Box 9.1. MDB-backed SPVs to open green markets for sub-investment-grade sovereigns

Goal: enable BB/B sovereigns to issue affordable green bonds at scale by using MDB credit enhancement inside a bankruptcy-remote SPV, lifting issues to investment grade and crowding in long-term investors.

How it works

- **Structured SPV**: pools diversified sovereign (and eligible quasi-sovereign) green assets; transparent rules for tranche seniority, cash flows and reporting, aligned with the International Capital Market Association (ICMA) Green Bond Principles.
- **MDB credit enhancement**: first-loss/equity or partial guarantees to deliver rating uplift (e.g. BB→BBB), cutting funding costs by roughly ~200 bps and supporting repeat issuance.
- **Design for official-sector eligibility**: target investment-grade ratings, high-quality collateral, simple structure and strong disclosure so the vehicle meets central bank reserve-management criteria (liquidity, safety, transparency).
- **Anchor official buyers**: possibly tap the ~US$12 trillion pool of central bank FX reserves (including via reserve-friendly green bond funds and BIS-type platforms such as the BIS Investment Pools or BISIPs) as cornerstone investors, alongside pensions/insurers/asset managers. BISIPs are open-ended, Swiss-law pooled funds run by BIS Asset Management for the official sector. They are designed for central bank reserve managers, with conservative mandates and clear eligibility rules. BIS has used the BISIP format for multiple fixed-income strategies, including the green bond funds central banks already use.
- **Scalable pipeline**: standardised documentation, country diversification and periodic taps build a durable, revolving channel for climate finance.

Why it matters

- **Lower spreads, stronger access**: rating uplift reduces coupons and extends tenors for climate investment
- **Debt sustainability**: cheaper financing improves rollover risk and interest burdens for EMDE sovereigns
- **Private capital at scale**: mobilises institutional demand for high-grade green assets while leveraging limited MDB capital efficiently

Governance and safeguards

- Independent verification of use-of-proceeds, impact reporting and climate alignment; clear fiduciary roles for arranger, trustee and verification agents; periodic performance reviews tied to MDB support

Box 9.2 uses the recent French discussion, and the Pisani-Ferry and Mahfouz (2023) report in particular, as an illustrative proposal for how an adaptive fiscal framework could be structured at the country level. The report is not presented as a forecast or a policy decision, but rather as a concrete example of the type of reasoning, sequencing and institutional design that an adaptive climate–fiscal framework would require.

Box 9.2. Case study of the proposed adaptive fiscal framework at the country level

Case study: France's approach to financing the transition

An illustration of how an adaptive fiscal framework can operate at the national level is provided by France's recent reflection on financing the climate transition. The Pisani-Ferry and Mahfouz (2023) report to the French Prime Minister highlights the scale of additional investment required — more than 2% of GDP annually by 2030 — and stresses that such front-loaded spending cannot be accommodated within rigid, debt-anchored rules. Instead, it argues for a pragmatic mix of instruments, including debt financing, temporary tax measures and expenditure reallocation, designed to smooth the intertemporal costs of the transition and preserve social cohesion. This approach exemplifies how adaptive fiscal policy frameworks, rather than mechanically targeting short-term deficit or debt ratios, can balance credibility with the urgent need to mobilise resources for climate neutrality.

The Pisani-Ferry and Mahfouz (2023) *France Stratégie* report makes a careful case that public debt should play a role in financing the climate transition, while warning against over-reliance on austerity.

The argument unfolds as follows.

Scale and urgency of investment: achieving climate neutrality requires an unprecedented acceleration — doing in 10 years what has barely been achieved in 30. This implies additional annual investment of more than 2% of GDP by 2030 (about €70 billion in France). These outlays are front-loaded and essential to substitute capital for fossil fuels.

Growth and productivity dynamics: these investments are not primarily growth enhancing in the short run. Redirecting resources from conventional capital deepening to decarbonisation will temporarily reduce productivity growth (by roughly 0.25 pp per year). The benefits of lower energy dependence, cheaper renewables and avoided damages will only materialise in the long run. This creates a temporal mismatch between costs (now) and benefits (later), justifying intertemporal financing through debt.

Distributional fairness: the transition imposes large, lumpy costs on households, such as home retrofits and replacement of vehicles. Without public support, many cannot shoulder these costs upfront, even if lifetime savings are positive. Debt financing allows the state to smooth these costs over time and across generations, making the transition politically and socially sustainable.

Debt sustainability perspective: the report estimates that, even with compensatory fiscal measures, public debt may rise by around 10 points of GDP by 2030, 15 points by 2035 and 25 points by 2040. It argues that this is manageable compared to the cost of inaction and also post-war debt trajectories, provided that the credibility of the fiscal frameworks is maintained.

Against austerity logic: delaying climate spending in the name of preserving debt ratios would be counterproductive. The cost of catching up later would be much higher, given technology lock-ins and climate damages. As Pisani-Ferry puts it: "Public debt is not the main instrument for financing

the climate transition. However, excessively restricting its use could further complicate the task for policymakers."

Complementary instruments: debt is necessary but not sufficient. The report also calls for the reallocation of existing expenditures (e.g. phasing out fossil subsidies) and, if needed, temporary tax increases — including a possible one-off levy on the wealthiest households' financial assets — to contain the fiscal burden. Still, intertemporal smoothing through debt remains central to the financing strategy.

In short, the report argues that debt financing is legitimate and necessary to spread the immediate, heavy costs of the climate transition across time and generations, ensuring fairness, feasibility and credibility — while cautioning against both procrastination and excessive austerity.

10. Regulatory reforms to foster more green investment in emerging markets and developing economies

As mentioned above, higher growth from green investment will relax fiscal and debt constraints. This is especially critical in EMDEs, which require the facilitation of capital flows and the removal of barriers from investing in the transition.

Pereira da Silva (2025b) argues that closing the climate finance gap is both urgent and feasible, but requires a sequenced package of adaptive regulatory reforms and international cooperation. Barriers such as procyclical prudential rules, biased sovereign credit ratings, FX and convertibility risks, fragmented taxonomies and limited guarantees drive up risk premia and deter private investment. The report proposes a comprehensive agenda: targeted Basel III adjustments and recognition of MDB guarantees, convergence of taxonomies and disclosures, reforms of credit rating agencies, expanded FX hedging and de-risking instruments, mobilisation of institutional investors (sovereign wealth funds, pensions, insurers) and scaling of blended finance through MDBs and global climate funds. It stresses that banks alone cannot deliver the needed volumes, and the centre of gravity must shift towards institutional capital supported by guarantees, technology — distributed ledger technology (DLT), AI-enabled measurement, reporting and verification (MRV), and central bank digital currencies (CBDCs) — and concessional anchors such as global solidarity levies.

With proper sequencing, coordination and political will, these measures could realistically close the financing gap and align EMDE development pathways with net-zero goals. In this section we focus on the role of credit rating agencies in assessing investors' risks.

10.1. Why credit rating agency methodologies matter for sovereign risk premia

Credit rating agencies play a central role in shaping how sovereigns access capital markets and at what cost. Their methodologies have a direct influence on the calculation of sovereign risk premia, which in turn affect the borrowing costs of countries seeking to finance large-scale climate investment. As Pereira da Silva (2025b) underlines, current credit rating agency practices often fail to differentiate between debt incurred for short-term consumption and debt contracted for productive, growth-enhancing investment, such as climate mitigation and adaptation

This can bias outcomes against governments that undertake ambitious climate programmes, since their debt ratios rise without recognition of the long-term growth and resilience benefits.

Reforming credit rating agency methodologies to explicitly incorporate the macroeconomic and risk-reducing effects of climate investment could therefore have a transformative effect. For example, sovereigns that channel borrowing into renewable energy, resilient infrastructure, or climate adaptation would see creditworthiness strengthened over time, given the reduction in their exposure to climate shocks; the crowding-in of private investment; and the enhancement of potential growth. If credit rating agencies integrate such forward-looking assessments, sovereign risk premia could decline, lowering borrowing costs precisely where climate investment is most needed.

Moreover, current rating practices tend to amplify procyclicality: risk premia rise sharply during downturns or after climate disasters, tightening financing conditions when public investment is most urgent. Pereira da Silva (2025b) argues that an adaptive approach to ratings — factoring in state-contingent fiscal rules, insurance mechanisms and the role of MDB guarantees — would reduce this bias. By recognising credible risk-sharing arrangements and external buffers, credit rating agencies could provide more stable ratings, helping countries maintain access to affordable financing through climate shocks.

In practice, reforming credit rating agencies requires both regulatory oversight and pressure from market participants. Supervisory bodies could mandate greater transparency on how climate risks and climate investment are reflected in sovereign ratings. Investors, too, have an incentive to support reform, as more accurate risk assessments would expand the pool of investable green sovereign bonds and structured products. Aligning credit rating agency methodologies with the realities of climate transition would thus serve both fiscal sustainability and investor confidence.

There is also an important economic argument that is alluded to in Box 4.1 for sovereign risk premia. Climate investments are credit enhancing over the medium term, and this should find its way back into certain metrics eventually. There is a relatively small but robust academic and IMF literature finding that countries investing in climate resilience benefit from better ratings. That is an important argument for the suggestion in this report that countries rely more on debt-financing for the transition.

In sum, reforms of credit rating agencies — by correcting methodological biases, reducing procyclicality and valuing the long-term benefits of climate investment — can help reshape sovereign risk premia. This would ease fiscal constraints, lower the cost of green borrowing and ultimately accelerate the mobilisation of private finance for the climate transition.

10.2. Mandated changes in credit rating methodologies

Credit rating methodologies should evolve to incorporate climate risk and resilience factors more explicitly, so that countries investing in adaptation and mitigation are not penalised with higher borrowing costs in the short term. The idea is that forward-looking DSAs and ratings should recognise the positive long-term fiscal effects of climate investment (reduced disaster costs, preserved growth potential) rather than focusing narrowly on near-term debt metrics.

The report advocates for a globally coordinated update of credit rating agency methodologies — through multilateral agreement or regulatory mandate — to incorporate climate risk and resilience factors into sovereign default probability models. This reform should also ensure recognition of climate-adjusted stochastic DSAs, concessional finance and the differentiated risk profile of green and resilience investments. Harmonising these methodologies across agencies would prevent inconsistencies that undermine climate-oriented fiscal strategies.

10.3. Harmonising credit rating agency treatment with climate-adjusted stochastic DSAs and IFIs

The report also calls for greater harmonisation between credit rating agencies and international financial institutions, so that climate-adjusted DSAs developed by the IMF, World Bank and MDBs are reflected more accurately in sovereign ratings. This would involve integrating climate stress tests and scenario analysis into DSAs, adjusting sovereign credit risk assessments to account for the lower probability of default when climate adaptation is credibly financed and revising rating methodologies so that concessional climate finance and MDB guarantees strengthen debt metrics, instead of being treated equivalently to commercial debt.

10.4. Methodological issues: data, transparency and procyclicality

Methodologically, credit rating agencies rely on a mix of quantitative indicators and qualitative judgments (such as debt-to-GDP, fiscal balances, external accounts, governance, policy credibility, institutional quality). Sovereign ratings combine objective indicators with discretionary judgments on governance and institutions, leaving ample space for subjective overlays. Their reliance on limited or inconsistent data in EMDEs further amplifies measurement issues, since missing or noisy variables are

often interpreted negatively. Ratings remain opaque; methodological choices, weightings and qualitative overlays are rarely disclosed in a way that allows replication or challenge. This opacity is compounded by the oligopolistic structure of the industry and the conflicts of interest inherent in the issuer-pays model.

10.5. Implications for emerging markets and developing economies and private capital mobilisation

Credit rating agencies' biases and methodological shortcomings have direct implications for the green transition in EMDEs. Sovereign borrowing to finance climate mitigation or adaptation is often treated as a pure liability by credit rating agencies, without accounting for the long-term resilience and growth benefits such investments bring. In practice, this means that climate projects raise debt ratios and trigger negative rating outlooks, reinforcing investor reluctance to finance them. The result is a vicious circle: EMDEs, already constrained by lower ratings and higher spreads, are penalised further when they attempt to invest in the very projects that could improve long-term sustainability. In this way, the shortcomings of CRA methodologies not only sustain a structural bias against developing countries but also compound the obstacles they face in mobilising private finance for green investment.

This critique has been developed in various ways in the literature. Blanchard (2019) emphasises that when the interest rate on government debt is below the growth rate of the economy, high debt levels can remain sustainable without requiring painful fiscal adjustment. Wyplosz (2011) and De Grauwe (2011) have highlighted the dangers of relying excessively on the debt-to-GDP ratio in Europe, where it served as the cornerstone of the Maastricht criteria, often leading to procyclical austerity. Stiglitz (2016) similarly argues that excessive focus on arbitrary thresholds of debt-to-GDP has undermined investment and recovery, particularly in crisis-hit economies. Even the IMF has noted in its evolving Debt Sustainability Framework (IMF, 2013, 2021) that debt service-to-revenue ratios and market access indicators are often more reliable in assessing risks than the debt-to-GDP ratio alone.

Box 10.1. Credit rating agencies and the need for overhaul

Credit rating agencies — principally the 'big three' of Moody's, Standard & Poor's and Fitch — **play a central role in global financial markets.** Their ratings assess the creditworthiness of sovereigns, corporations and financial instruments, influencing borrowing costs, investor allocations and regulatory capital requirements. Methodologically, **credit rating agencies** rely on a mix of quantitative indicators (such as debt-to-GDP, fiscal balances, external accounts) and qualitative judgments (on governance, policy credibility, institutional quality). However, their assessments are widely criticised for procyclicality — downgrades often occur during or after crises, exacerbating market stress — and for being lagged, with ratings failing to anticipate turning points or structural vulnerabilities.

Credit rating agencies' shortcomings were starkly exposed during the 2007–2009 global financial crisis (GFC), when they were singled out for their central role in amplifying systemic risk. Before the GFC, by assigning overly generous ratings — often AAA — to mortgage-backed securities and collateralised debt obligations that later collapsed, Moody's, Standard & Poor's and Fitch were accused of having misled investors and contributed to the scale of the crisis. Their methodologies, opaque and prone to conflicts of interest, came under severe scrutiny.

In the US, the response combined legal and regulatory action. The Department of Justice and several states launched lawsuits alleging that agencies knowingly inflated ratings. These culminated in large settlements — US$1.375 billion for Standard & Poor's (2015) and US$864 million for Moody's (2017) — though without criminal convictions. Fitch largely avoided major sanctions. Parallel reforms through the Dodd–Frank Act (2010) sought to reduce regulatory reliance on ratings, enhance credit rating agency liability and strengthen oversight by the US Securities and Exchange Commission (SEC).

In Europe, the emphasis was on structural reform rather than sanctions. A trilogy of regulations (CRA I–III, 2009–2013) established direct supervision under the European Securities and Markets Authority

(ESMA), imposed civil liability for gross negligence, mandated rotation rules for structured product ratings and tightened disclosure and conflict-of-interest requirements. Unlike in the US, no major fines were levied, but compliance costs and institutional oversight increased significantly. At the global level, the Financial Stability Board (FSB) and the G20 recommended reducing "mechanistic reliance" on credit rating agency ratings in prudential regulation, strengthening internal credit risk assessment capacities among banks and investors, and encouraging alternatives to the dominant oligopoly (FSB, 2020). The FSB also launched peer reviews to track countries' progress, while the International Organization of Securities Commissions (IOSCO) revised its Code of Conduct (2008, 2013) to reinforce transparency, independence and responsibilities towards issuers and investors.

These reforms brought tangible progress: nearly all jurisdictions now require credit rating agency registration and oversight; disclosure standards have improved; and explicit references to ratings in regulation have been reduced in many cases.

Yet challenges remain. Mechanistic reliance is hard to eliminate entirely, especially in banking regulation. Implementation is uneven across jurisdictions, with emerging markets lagging behind. Data and methodological gaps hinder full evaluation of reforms, while fundamental incentive problems tied to the issuer-pays model remain unresolved. The bottom line is that post-GFC reforms improved transparency, oversight and regulatory diversity in the use of ratings, and imposed meaningful sanctions in the US. But the agencies remain powerful oligopolists, and their influence on markets and regulations is still substantial. The core vulnerabilities — procyclicality, opacity and structural reliance on a handful of private providers — were only partly addressed.

11. Institutional innovation

Translating the principles of an adaptive fiscal framework into credible, actionable policy requires institutional reforms with new analytical tools.

11.1. National level institutional innovation

As mentioned above, governments should create a central coordinating body — whether a cross-government climate and transition committee or a strengthened planning/climate agency — with the authority and technical capacity to align all ministries around a unified climate development strategy, prevent fragmentation of climate spending and ensure coherent investment, taxation and engagement with external partners. A specific coordinating role needs to rest with the Ministry of Finance.

Independent budget evaluation office

In addition, a national, independent fiscal institution — modelled on the US Congressional Budget Office (CBO) — should be established to produce non-partisan assessments of budgetary policy, debt sustainability and the macroeconomic implications of climate-related spending and financing. This body would assess the long-term impact of mitigation and adaptation investments, including their effects on growth, fiscal balances and resilience, and would make its findings public to strengthen transparency and accountability.

Such institutions reduce fiscal unpredictability — arguably the variable markets fear most — by ensuring that investment plans, revenue strategies and debt paths are evaluated consistently across political cycles. The goal is not merely to signal fiscal discipline, but to provide a stable informational structure that survives electoral turnover, lobbying pressures and short-term political incentives. National IFIs similarly highlight the need for regular, independent assessments of climate transition measures and their fiscal implications (Oliinyk et al., 2022).

The role of Ministries of Finance as coordinators

Ministries of Finance should act as *primus inter pares* — for example, alongside the Ministry of Planning — in promoting adaptive fiscal policy and integrating green financing strategies into fiscal planning.

They can advocate for prioritising green instruments to lower the effective cost of capital for the transition, using tools such as the greenium and swaps to offset temporary increases in debt ratios associated with climate investment. They will also need to coordinate with credit rating agencies, international financial institutions, and investors to ensure debt strategies are aligned with national climate goals. This requires leading the alignment of climate and fiscal strategies at the national level and engaging with regulators, central banks, and line ministries on shared transition plans. Ministries of Finance should guide the design of fiscal instruments tailored to national circumstances and climate risks, and they must build institutional capacity for adaptive fiscal planning and scenario-based decision-making. Recent guidance for finance ministries stresses that building in-house modelling capacity and partnerships is essential, including hiring and maintaining specialists with mastery of modelling tools and methods in the Ministry of Finance and cooperating with various stakeholders, such as experts from different fields and sectors (Tamminen et al., 2022).

Coordinating fiscal and monetary policy for a better macro policy mix

Adaptive monetary and fiscal policies are complements in a climate-constrained economy. When climate shocks push inflation up, mechanical monetary tightening — without regard to the source and persistence of the shock — can raise funding costs, depress green investment and slow the very supply-side adjustments (renewables, grids, resilience) that would lower inflation pressures over time. Conversely, fiscal austerity undertaken to quell debt concerns can reinforce stagnation, delay adaptation and ultimately worsen debt dynamics by shrinking the growth denominator. An adaptive stance preserves the core mandates of price stability, financial stability and debt sustainability, while recognising that climate shocks alter the optimal intertemporal mix of stabilisation and investment.

Why should finance ministries care about the monetary side?

Climate shocks create monetary trade-offs that directly affect fiscal space, debt dynamics and the affordability of green investment. Physical shocks such as droughts and heatwaves raise food and energy prices, triggering inflation that can prompt central banks to tighten policy, even when output is weak. Transition shocks can raise carbon-related input prices during the adjustment, again putting upward pressure on headline inflation. Higher interest rates increase debt-service costs, crowd out public investment, and raise sovereign risk premia, especially for countries already near debt limits.

In this environment, the absence of coordination leads to a procyclical policy mix: fiscal contraction to stabilise debt and monetary tightening to stabilise inflation reinforce each other, suppressing growth and delaying the very investments that would ease future inflationary pressures. For finance ministries, understanding and engaging with these monetary trade-offs is therefore essential to protect fiscal space, sustain green investment and maintain debt credibility.

Coordination should rest on shared analytics and clear rules of the game

First, adopt joint macro-climate scenario analysis that feeds both budget plans and the monetary policy strategy, so interest rate, investment and debt paths are evaluated against consistent climate and energy assumptions. Second, use climate-adjusted inflation and growth forecasts — explicitly distinguishing transient price spikes from persistent supply capacity changes — to calibrate policy horizons and avoid procyclical tightening. Third, enshrine a division of responsibilities: fiscal policy leads on investment, transition financing and redistribution — including targeted transfers to maintain social support — while monetary policy safeguards price and financial stability and leans against second-round effects and de-anchoring.

Delivering coordination requires modest but concrete institutional innovations

A fiscal–monetary coordination platform that includes the independent fiscal council and financial supervisor should be established that runs the shared scenarios, times ‘green golden rule’ investment windows and flags when climate contingencies in fiscal rules are triggered or unwound. Regular joint technical notes — not joint decisions — should be published explaining how each authority interprets the climate shock, its transmission channels and the consistency of the interest rate path with the medium-term fiscal anchor. This preserves operational independence while providing a coherent,

state-contingent policy narrative that keeps risk premia low, protects priority green investment and maintains credibility on both inflation and debt.

A renewed role for a Ministry of Planning as an institutional tool could also strengthen the coordination of climate-related fiscal, monetary and structural policies. In the decades following the Second World War, many countries — including France with its Commissariat général du Plan — used national planning bodies to articulate long-term development priorities, align public investment with industrial policy and coordinate across ministries and social partners. During the war itself, the US created powerful coordination bodies such as the War Production Board (WPB) and the Joint Chiefs of Staff, which mobilised industry, prioritised scarce inputs and ensured unified decision-making across the executive branch.

These institutions did not replace markets; they provided the strategic capacity needed to steer national production during an existential crisis. While such planning institutions waned with the rise of market-led frameworks, the scale and intertemporal nature of the climate transition creates a strong case for their reactivation in modern form. A planning institution for the climate era would not entail rigid central planning, but rather provide a platform for joint scenario analysis, priority setting and multi-year budgeting, ensuring that fiscal choices, regulatory reforms and monetary strategies are coherent with national and international net-zero pathways. Such an institution could serve as a bridge between government, independent fiscal councils, central banks and civil society, offering the strategic coordination capacity that fragmented policymaking often lacks today.

11.2. The international dimension and global coordination: the Global Climate Agency and global green fiscal funds

As discussed above, a GCA is needed because no existing international institution has the mandate, legitimacy, or instruments to coordinate global climate taxation, pool and redistribute revenues, and ensure a fair and effective allocation of mitigation and adaptation efforts. The Bretton Woods institutions were designed for macro-stability and post-war reconstruction, not for managing a planetary externality with long horizons, large uncertainties and deep distributive implications, and the current system is fragmented across diagnostic bodies, negotiation forums and vertical climate funds with no executive integrator. A GCA would fill this institutional gap by setting common standards, coordinating global financing, organising burden sharing and aligning capital flows with NDCs and a 1.5–2°C pathway.

In addition, given the challenges, Ministries of Finance must shape the reform of global financial architecture to support adaptive fiscal policy. They should mobilise concessional finance and special drawing rights (SDRs) for resilience and decarbonisation, and expand and reform MDB guarantees, capital adequacy and risk-weighted lending practices (Circle of Finance Ministers, 2025). They must design and participate in country platforms (JETPs, Loss and Damage Fund) and South–South cooperation initiatives.

A promising innovation in global fiscal architecture would be the expansion and reinforcement of global climate financing mechanisms (as stated in Box 6), building on institutions such as the Green Climate Fund (GCF), which was established under the UNFCCC to support mitigation and adaptation efforts in developing countries. To meet the growing scale and urgency of climate needs — particularly in low-income and climate-vulnerable countries — a new or significantly scaled-up Global Green Fiscal Fund could be envisioned. This fund would be financed through a diversified mix of sovereign contributions, global solidarity levies (such as taxes on international aviation, maritime transport, or financial transactions), voluntary private donations and, over time, global wealth or global carbon taxes.

Beyond financing national climate transitions, such a fund would act as a global macro-fiscal buffer, capable of providing countercyclical support in the face of climate shocks and natural disasters. For low-income countries with limited fiscal space and acute climate exposure, access to predictable, concessional and rules-based financing is essential; not only for fairness and climate justice, but also for ensuring global financial and ecological stability. Institutionalising such a fund with broad political legitimacy and strong governance standards would represent a vital step towards a globally coordinated fiscal response to the climate crisis.

12. Equity measures: social transfers to mitigate regressive transition impacts

Transition costs are regressive if left unaddressed. We know that carbon pricing disproportionately affects low-income households and that adaptation costs and technology shifts are unaffordable for many. Therefore an adaptive fiscal policy must include:

- Targeted transfers and subsidies for energy, transport and housing
- Progressive tax reforms to finance equitable transition measures
- A social dialogue and participation to ensure legitimacy and policy continuity

Equity is not just normative, it is crucial for achieving climate and fiscal sustainability. Climate policies need to compensate vulnerable groups hit by carbon taxes, adaptation costs, or job dislocation. Many of the instruments to address the issue are mentioned in Box 7.1.

Mitigation strategies

Design transfers to be temporary, tightly targeted and — where appropriate — conditional, with explicit sunset clauses and regular reviews. Frame the package as budget-neutral, embedding it within a carbon-pricing-with-redistribution reform that recycles a transparent share of carbon revenues to vulnerable households. Operationally, route support through the tax–benefit system as automatic stabilisers (e.g. refundable credits, energy vouchers triggered by price thresholds) rather than ad hoc programmes, so the fiscal impact is predictable, self-adjusting over the cycle and consistent with the medium-term anchor.

13. Adaptive fiscal frameworks by country archetype[1]

From generic principles to differentiated application

The preceding sections discussed the principles and operational building blocks for an adaptive fiscal framework in generic terms. Yet, in practice, fiscal room for manoeuvre, institutional credibility and market access differ sharply across countries. Climate shocks are universal, but fiscal and financial capacities are not.

If adaptive fiscal policy is to be credible and effective, it must be differentiated — anchored in country-specific realities and matched to the appropriate set of instruments. As the NGFS has provided scenario frameworks for central banks, Ministries of Finance now need a comparable 'climate–fiscal scenario architecture' that calibrates fiscal space, debt dynamics and financing strategies to national circumstances.

Six criteria are particularly relevant for such differentiation:

1. Income level (high-income versus low- and middle-income countries)
2. Access to capital markets (investment-grade versus below investment grade)
3. Exposure and endowments (fossil dependence, natural-capital assets, vulnerability to physical shocks)
4. Technological capacity (availability and diffusion of green technologies)
5. Regulatory stance (readiness for carbon pricing, CBAM alignment, global solidarity levies)
6. Scope for central bank and international support (FX or liquidity lines, guarantees, SDR recycling, multilateral insurance)

[1] This section will be further developed in a forthcoming paper, 'Green Swan 2 for Ministries of Finance', by LA Pereira da Silva, E Espagne, H Lapeyronie and R Svartzman.

Based on these criteria, four broad archetypes emerge. They provide a pragmatic map for tailoring adaptive fiscal strategies and linking each to an appropriate portfolio of instruments, financing mechanisms and international risk-sharing tools.

13.1. Archetype A: advanced economies (high income, deep markets, green tech capacity)

- Problem: advanced economies combine credible institutions and deep financial markets with high legacy debt, ageing social contracts and political fragmentation. Climate spending must compete with entrenched expenditure on defence, health and pensions.
- Fiscal stance: they can implement an adaptive fiscal framework built around a green golden rule, allowing capital expenditure for certified mitigation and adaptation projects to be debt-financed within a transparent, time-bound 'green envelope'. The rule should include an explicit re-entry path towards the medium-term anchor once the investment hump peaks.
- Revenue mix: scaling up carbon pricing and subsidy reform can provide 1–2% of GDP in additional fiscal space. Approximately one-third to one-half of the proceeds should be recycled through targeted transfers and public goods to maintain social consent; the remainder can service green debt or capitalise transition funds.
- Financing and instruments: sovereign green-bond programmes with KPI-linked or step-down coupons should be expanded and integrated with climate–fiscal dashboards disclosing outlays, avoided-loss estimates and debt trajectories. Fiscal councils and independent budget offices can certify green envelopes and climate-adjusted DSAs.
- International role: advanced economies should lead on taxonomy interoperability, CBAM implementation and global solidarity levies, while supplying callable capital and guarantees to de-risk EMDE green issuance through multilateral platforms.

13.2. Archetype B: middle-income economies with investment-grade market access

- Problem: these economies enjoy positive access to capital markets but remain exposed to risk-off episodes, imported energy shocks and volatile spreads. Their fiscal frameworks are often rule-based but lack mechanisms to protect transition investment during downturns.
- Fiscal stance: a dual-book accounting system that separates legacy from green accounts should be embedded in the budget law. This enables climate-adjusted DSAs to protect transition capex from across-the-board cuts and maintain medium-term credibility.
- De-risking and liquidity instruments: to smooth the cost of capital, governments can rely on MDB partial guarantees, first-loss tranches and pooled-issuance SPVs that aggregate sovereign and state-owned-enterprise green projects. FX-hedging facilities and repo/swap backstops pre-arranged with central banks or regional funds reduce currency risk and prevent stop–go cycles in public investment.
- Revenue and industrial policy: gradual carbon pricing combined with dividend transfers protects households and ensures political feasibility. Selective industrial policy — for example, supporting local supply chains for clean-energy equipment — helps crowd in private capital where technological capacity exists.
- Institutional dimension: success depends on integrating fiscal–monetary-prudential coordination and establishing scenario-based fiscal planning units akin to NGFS task forces.

13.3. Archetype C: middle-income economies below investment grade (middle-income risk class)

- Problem: these economies face high sovereign spreads, shallow domestic markets and currency mismatch, often coupled with fossil fuel dependence or limited green-tech bases. Market perceptions of risk are often excessive and poorly differentiated.

- **Fiscal stance**: they should maintain a narrow, KPI-linked green envelope, pairing each new borrowing with an external credit enhancement. Fiscal flexibility must be explicitly state-contingent, activated solely for verified climate shocks or certified transition investment.
- **Financing instruments**:
  - Guarantee-wrapped green bonds and sustainability-linked instruments with step-down coupons conditional on climate-performance KPIs
  - Debt-for-climate swaps exchanging legacy debt for investment in resilience
  - Parametric disaster insurance layered with contingency credit lines to prevent liquidity crises after shocks
- **Revenue side**: solidarity levies on aviation and maritime transport, royalty and fossil-rent reforms, and pilot carbon-pricing schemes with visible compensation for low-income households can create limited but predictable revenue streams while demonstrating policy credibility.
- **International layer**: these economies require priority access to guarantee platforms, SDR-recycling mechanisms and FX risk-sharing facilities. MDB-supported credit enhancements and pooled-issuance vehicles are critical to compress risk premia and lengthen maturities.
- **Policy objective**: the goal is to shift perceptions from climate risk as a penalty to climate investment as a risk-reduction strategy through transparent, externally verified fiscal operations.

13.4. Archetype D: low-income and fragile states (high vulnerability, rich natural capital)

- **Problem**: limited fiscal capacity, recurrent disasters and high dependency on external aid mean that these countries are the most exposed to physical climate shocks yet the least able to respond.
- **Fiscal stance**: priority must be given to grant-heavy, results-based packages and cash-transfer safety nets to prevent regressive effects. Fiscal frameworks should focus on resilience and social protection, not mechanical consolidation.
- **Instruments**:
  - Green budget support blended with grants and concessional finance
  - Catastrophe and resilience bonds to provide rapid liquidity post-disaster
  - Nature-based revenue instruments such as jurisdictional REDD+ and biodiversity credits, governed by transparent benefit-sharing mechanisms
- **International mechanisms**: the Global Climate Agency should be managing a global green fiscal facility that can pre-arrange grants, guarantee overlays and insurance payouts for such states. Credit-rating methodologies should explicitly recognise resilience assets and concessionality, reducing the procyclicality of financing costs.
- **Complementarity**: adaptive fiscal policy in these contexts overlaps with development and humanitarian agendas; its effectiveness depends on sustained external support and capacity-building for public financial management.

13.5. Cross-cutting principles

Despite their differences, all archetypes share three essential design principles:

1. **Debt separation**: ring-fence transition investment from legacy obligations through transparent accounting; publish the temporary 'green debt hump' and the dated path back to the anchor.

2. **Climate-adjusted credibility**: integrate climate-adjusted stochastic DSAs and independent fiscal certification into the budget process; communicate through a no-surprises regime using dashboards, KPIs and contingency triggers.

3. **Equity and social durability**: hard-wire redistributive transfers and provide affordable alternatives (public transport, retrofits, clean heating) so that carbon and energy policies remain politically sustainable.

Additional priorities include international coordination on risk-sharing and a commitment to transparent, comparable scenario analysis across all fiscal authorities. It is also important to clarify that the credibility of a temporary green debt hump is not automatic. Markets are unlikely to accept a prolonged period of elevated debt unless specific conditions are in place. Unlike the Covid-19 shock, where the debt increase was short-lived and the economic rebound rapid, the payoff from climate investment is gradual and unfolds over decades.

Nonetheless, markets may tolerate multi-year, investment-led increases in debt when some criteria are met, for instance:

- When borrowing is transparently linked to productive, growth-enhancing assets — as in post-war reconstruction or large-scale infrastructure expansions

- When the hump is framed within a credible medium-term fiscal anchor with a dated re-entry path

- When external partners provide structured risk sharing through guarantees, liquidity lines and concessional buffers that limit tail risks

The green debt hump should therefore be understood as conditional: its credibility depends on governance, transparency, verifiable investment pipelines and international de-risking mechanisms that make long-term benefits legible to investors. When governments provide multi-year visibility on green outlays, revenue flows and re-entry to the medium-term anchor, markets can price the trajectory with far less uncertainty. A transparent plan reduces the fiscal unpredictability premium even if headline debt rises temporarily.

13.6. Towards a global fiscal scenario architecture

The typology above highlights a simple but profound reality: fiscal policy for climate cannot be one size fits all. Adaptive frameworks must reflect each country's exposure, fiscal capacity and institutional credibility while being anchored in a coherent global architecture of information and support.

To that end, Ministries of Finance should develop shared climate–fiscal scenarios, analogous to NGFS scenarios for central banks, to guide medium-term budget planning, debt management and coordination with MDBs and investors. Differentiation across archetypes is not a source of fragmentation but of realism and resilience.

Ultimately, the credibility of these adaptive fiscal paths will depend on how governments communicate them to markets and citizens — transforming diversity into a common narrative of fiscal adaptation. The next section turns to this issue: how to secure market confidence through transparency, sequencing and effective communication of adaptive fiscal frameworks.

Table 13.1. Adaptive fiscal frameworks by country archetype				
Dimension/ archetype	A. Advanced economies (high income, deep markets, green-tech capacity)	B. Middle-income (investment-grade access)	C. Middle-income below investment grade (middle-income risk class)	D. Low-income and fragile states (high vulnerability, rich natural capital)
Main problem	High legacy debt; credible institutions but fragmented politics; ageing societies; multiple spending priorities (defence, health, pensions, climate)	Positive market access but vulnerable to risk-off episodes, imported energy shocks and volatility of capital flows	High spreads, shallow domestic markets, fossil dependence, currency risk, limited green-tech base	Minimal fiscal space, low tax capacity, recurrent disasters, limited administrative bandwidth
Fiscal stance/ framework	Adaptive framework with green golden rule; ring-fenced green envelope; dated re-entry path to medium-term anchor	Dual-book accounting (legacy versus green) protecting transition capex; embed climate-adjusted stochastic DSA in budget law	Narrow KPI-linked green envelope; pair all new borrowing with credit enhancement; climate-contingent clauses	Grant-heavy, results-based financing; focus on resilience and social protection; adaptive safety nets
Revenue mix	Scale carbon pricing + subsidy reform; recycle 30–50% of proceeds to targeted transfers, remainder to service green debt	Gradual carbon pricing with dividends; selective industrial policy to crowd in private capital; reform fossil fuel subsidies	Solidarity levies (aviation/shipping); fossil rent and royalty reforms; pilot carbon pricing with visible compensation	International grants, concessional finance and nature-based revenues (REDD+, biodiversity credits); minimal domestic taxation burden
Key instruments/ financing tools	Sovereign green bonds with KPI-linked features; climate–fiscal dashboards; medium-term fiscal anchors with transparent envelopes	MDB partial guarantees; first-loss tranches; pooled-issuance SPVs; repo/swap backstops; FX-hedging facilities	Guarantee-wrapped/sustainability-linked bonds (step-down coupons); debt-for-climate swaps; parametric insurance + contingency lines	Green budget support blended with grants; catastrophe bonds; results-based and nature-linked instruments
Institutional priorities	Independent fiscal councils certifying green investment; coordination between Ministry of Finance, CB and parliament; disclosure standards	Integration of climate scenarios into budget law; coordination of fiscal–monetary–prudential policies; enhanced data capacity	Strengthened debt management offices; partnership with MDBs for guarantee structuring and verification; credible KPI monitoring	Simplified reporting frameworks; strong international technical assistance; local capacity-building for fiscal resilience

International role/support mechanisms	Lead on taxonomy interoperability, CBAM, global solidarity levies; provide callable capital/guarantees to de-risk EMDE issuance	Access MDB and regional guarantee platforms; participate in FX liquidity lines and SDR recycling initiatives	Priority access to global guarantee platforms, SDR recycling, FX risk sharing; concessional credit enhancement for green debt	Benefit from Global Green Fiscal Facility: pre-arranged grants, insurance payouts, guarantee overlays; rating-methodology reforms to recognise resilience assets
Equity/social durability	Targeted transfers + public goods investment to sustain consent for carbon pricing; transparent communication of green envelope	Carbon dividend schemes + industrial job programmes to offset distributional impacts	Compensation for low-income households; visible social co-benefits to secure legitimacy	Cash transfer safety nets + community benefit sharing in nature-based projects
Cross-cutting principles	Separate green/legacy debt; publish temporary green debt hump + dated return path; communicate with markets	Climate-adjusted credibility via DSAs + independent certification; no-surprises communication regime	Embed equity and risk-sharing in fiscal frameworks; align national plans with MDB/IFI instruments	Ensure fairness and capacity support; recognise resilience investments in sovereign ratings

Source: Author

14. Market credibility

There is a need to strengthen political and market credibility. Any relaxation of fiscal rules to accommodate green investment can be destabilising if not clearly communicated, time-bound and anchored in outcome-based frameworks (e.g. emissions reduction, adaptation coverage, or green capital formation). This protects credibility and avoids perceptions of fiscal laxity or loss of policy discipline. This requires a discussion about the role of credit rating agencies in their assessment of debt sustainability.

However, market credibility is not only dependent on the level of public debt, but also on the predictability, transparency and coherence of the fiscal path that governments commit to. Investors can price a clearly articulated, multi-year strategy, where legacy debt follows a credible consolidation trajectory and climate investment is financed through a transparent, ring-fenced green budget tied to productive assets. What undermines credibility is not borrowing for high-return climate investments, but discretionary, unpredictable fiscal behaviour. An adaptive fiscal framework strengthens credibility precisely by separating old and new budgets, publishing forward-looking green investment plans and providing stable KPIs and revenue assumptions — turning an uncertain transition into a fiscal trajectory that markets can reliably assess and price.

Obviously, there is no guarantee that an adaptive fiscal policy will convince financial markets that these new policies are sustainable. Therefore, it needs to propose additional arguments to frame the discussion.

14.1. Shift fiscal policy towards green investment in mitigation and adaptation — R&D and countercyclical, inclusive and resilience-oriented tools

The aim is to front-load high-quality climate investments that raise potential output and strengthen the economy's ability to absorb shocks, while cushioning vulnerable households and regions. Financial markets are likely to welcome this shift if it is clearly growth-enhancing and credibly improves long-run productivity. They will react negatively if they read it as a permanent move to higher structural deficits without a clear path back to the fiscal anchor.

To secure a positive market response, the strategy should be communicated as a transitional, front-loaded programme with a long-term growth dividend, not an open-ended spending drift. Institutional anchors — an independent green investment board or a fiscal council — should vet project quality and publish assessments. And revised fiscal rules with built-in flexibility should allow well-defined carve-outs for green investment, conditional on transparent, monitored output and resilience gains, so that flexibility is tied to measurable results rather than discretion.

14.2. Rethinking traditional financing tools and exploring innovative sources

The objective is to reassess the mix of taxes, debt and inflation financing while adding carefully designed international instruments — such as a carbon border adjustment, aviation levies, or a financial transaction tax — to broaden the base for climate and resilience spending. Markets will scrutinise this shift. They may worry about stealth debt monetisation or unconventional revenues that lack political backing; they may also discount international taxes as uncertain or too difficult to implement, and thus not consider them to be credible near-term sources.

The response must foreground credibility and sequencing. First, anchor any innovative levy in multilateral agreements (e.g. G20/OECD mandates) to demonstrate durability and legal feasibility. Second, commit to revenue transparency and earmarking: publish conservative revenue scores and dedicate proceeds to debt servicing and clearly defined green investments, reassuring bondholders that new inflows strengthen sustainability rather than fund open-ended current spending. Third, sequence implementation through pilots, phased rollouts and sunset clauses tied to measurable milestones; this builds a history before scaling. Throughout, reaffirm central bank independence and exclude monetary financing to dispel monetisation concerns, while using medium-term fiscal frameworks to integrate these revenues prudently into the overall budget path.

14.3. Improving debt sustainability frameworks for climate investment

The goal is to permit transitional increases in debt ratios when borrowing finances verifiable green investments that raise potential output and resilience, with a pre-announced path back to the fiscal anchor. Markets could read this as a softening of discipline and demand higher premia; some rating agencies may reserve judgement unless the growth and reform story is credible.

To secure confidence, the framework must be model-driven, rule-bound and time-limited. Governments should publish climate-adjusted stochastic DSAs showing how net debt stabilises and then declines as green capex lifts growth and reduces disaster costs, alongside operational metrics such as a 'green-adjusted primary balance' and a 'net-zero fiscal anchor' that set caps, triggers and sunset clauses for the temporary deviation.

Independent verification of project quality and impacts, plus regular reporting, turns flexibility into a monitored commitment rather than discretion.

Finally, IMF/World Bank endorsement of the transitional framework should be sought and paired with concrete revenue measures and structural reforms. Where possible, MDB guarantees should be deployed to reduce funding costs. Clear communication that flexibility is state-contingent and reversible helps keep risk premia contained while enabling the investment needed for the transition.

Likely financial market reaction

Investors will scrutinise redistributive measures for their fiscal footprint. If transfers are not clearly matched by offsetting revenues or spending reprioritisation, markets may interpret them as a permanent widening of the structural deficit and demand higher risk premia. At the same time, credible social protection can lower policy and social unrest risk, supporting a more stable long-term investment environment — an element markets value when judging sovereign credibility.

To convince markets, adaptive fiscal policy must demonstrate that flexibility is temporary, rules-based and productivity-enhancing. Governments should:

- Frame green spending as growth-enhancing investment — front-load mitigation, adaptation and resilience projects vetted by independent bodies, with clear metrics on output and risk reduction, and a pre-announced path back to the fiscal anchor
- Anchor innovative financing in credibility — sequence new international levies or taxes through multilateral agreements, conservative revenue scoring, transparent earmarking and sunset clauses, while reaffirming central bank independence to avoid monetisation concerns
- Combine flexibility with discipline in debt sustainability frameworks — publish climate-adjusted DSAs, introduce green-adjusted fiscal anchors and obtain verification from fiscal councils, MDBs, or IFIs, ensuring that higher debt is temporary, rule-bound and linked to measurable returns.
- Communicate transparently and proactively — adopt a 'no surprises' regime: publish dashboards, engage investors regularly, and clarify revenue recycling and redistribution to protect vulnerable groups

In short, markets will accept a temporary green debt hump if it is rule-bound, independently verified transparently financed and visibly growth-enhancing — turning flexibility into a source of credibility rather than a signal of fiscal drift. When and if these elements are understood, a discussion could revisit fiscal anchors. Traditional numerical limits (e.g. Reinhart–Rogoff 80–90% debt-to-GDP limit or Maastricht 60% debt-to-GDP or 3% deficit thresholds) may no longer reflect optimal policy in a riskier, more investment-constrained world. Adaptive frameworks could allow for flexible debt anchors, conditional on investment returns and long-term sustainability goals.

Part V. Conclusion

Climate change is a fundamental challenge to the foundations of existing fiscal frameworks. As climate shocks become more frequent, persistent and systemic, fiscal policy must evolve beyond its traditional stabilisation function to embrace a structural mission: building resilience, accelerating the net-zero transition and ensuring social equity.

This transformation is made more difficult by high public debt, rising interest rates and growing market sensitivity to sovereign risk. The past decade, with its historically low rates and favourable debt dynamics, was a missed opportunity to finance climate action at much lower cost. Now, governments must act under far more constrained macro-financial conditions.

This means that there is double challenge. First, countries must stabilise legacy debt through socially just consolidation. Second, they must mobilise and manage the new climate-related debt needed for adaptation and mitigation — investment that raises resilience and potential growth but may temporarily push debt ratios higher.

Historical experience shows that when consolidations are carefully designed — protecting essential social spending, timing measures to avoid procyclical tightening and relying more heavily on progressive revenue mobilisation — **they can deliver substantial and lasting fiscal adjustments without undermining equity**. On average, such equitable consolidation packages have reduced fiscal deficits by around 2–3% of GDP over several years, sufficient to place debt on a stabilising trajectory. Framed in this way, the consolidation of legacy debt will not be an exercise in across-the-board austerity, but rather a structured and fair process that restores fiscal sustainability while maintaining social cohesion and creating the fiscal space needed for climate and development investments.

At the same time, climate action has substantial fiscal needs. Based on the quantitative studies reviewed in this paper, the order of magnitude of annual fiscal needs is roughly 2.5% of GDP for adaptation — with a very wide dispersion from ~0.01% up to ~15% in highly vulnerable or low-income settings — and about 1.4% of GDP for mitigation — ranging from ~0.01% to ~6.5%, depending on the policy mix and sectoral focus.[2]

Revenue potential, both domestic and international, is also sizeable, though politically constrained. Broadly, potential domestic revenue streams include carbon taxes/ETS, averaging ~0.90% of GDP (range ~0.01–3.0%); wealth taxes, averaging ~0.85% of GDP (range ~0.01–3.0%); and corporate income tax reforms, averaging ~0.85% of GDP (range ~0.01–3.0%). Together, these yield an indicative domestic total of ~2.6% of GDP, though the envelope implied by the reported ranges (~0.03–9% of GDP) is far wider and unrealistically large for most countries.

Potential international revenue streams include aviation and shipping levies, averaging ~0.58% of GDP (range ~0.01–1.5%); and a financial transaction tax, also averaging ~0.58% of GDP (range ~0.01–1.5%). Combined, these yield ~1.16% of GDP in indicative international revenue. Finally, fossil fuel subsidy reform can free fiscal resources, often exceeding 1.5% of GDP in emerging markets, though these may appear as savings rather than revenue.

Assuming that international revenues are more difficult to agree upon and collect, and in any event need to be shared among all countries, and that some domestic revenue proposals are also difficult to implement, a reasonable number for domestic revenue mobilisation would lie around 2–2.5% of GDP. That has to be compared to the mitigation and adaptation needs of around 4% of GDP. A preliminary conclusion would be that additional 'green debt financing' would amount to about 1.5–2% of GDP

[2] These figures are simple, unweighted averages computed from the studies' reported point estimates and the midpoints of ranges referring explicitly to public spending/needs/investment, and they should be read as indicative benchmarks and not country-specific figures.

annually — to which the necessary generation of a primary fiscal balance to stabilise legacy debt needs to be added. Table Conclusion 1 summarises these orders of magnitude.

Financial markets may initially view such climate-related fiscal expansions with caution. Additional spending, even if justified by long-term objectives, may be interpreted as widening structural deficits, weakening fiscal anchors, or delaying debt consolidation. This could raise sovereign risk premia, especially for countries with limited fiscal space or ambiguous climate strategies.

However, the adaptive fiscal architecture proposed in this paper is designed precisely to address these concerns. The establishment of dual fiscal accounts — that is, separating traditional budgets from clearly identified green investment spending — can provide transparency and discipline, enabling investors to distinguish between short-term consumption and long-term productive investment. The green budget can be financed through dedicated instruments, including verified green bonds, regional facilities, or a future global climate fund, all of which diversify financing sources and reduce pressure on traditional sovereign debt metrics.

Moreover, the adoption of outcome-based green fiscal rules, supported by independent institutions that review, verify and monitor investment quality, can offer the policy credibility that markets seek. Publishing long-term debt trajectories that incorporate the growth and resilience benefits of green investment, along with new fiscal indicators such as green-adjusted primary balances, can further shift perceptions from risk to opportunity. Coordination with IFIs and credit rating agencies to develop climate-sensitive debt sustainability assessments will also be critical for this credibility effort.

While markets may initially treat climate fiscal expansion as being riskier, a coherent, transparent and institutionally anchored fiscal strategy can reverse this narrative. With clear governance, verifiable taxonomies and predictable multi-year plans, green investment can be seen not as a fiscal threat, but as a growth-enhancing and risk-reducing response to the defining challenge of our time.

Table V.1. Fiscal needs, revenue potential and green debt financing (as % of GDP, annual averages)

Item	Average (% of GDP)	Range (% of GDP)	Notes
Legacy debt consolidation	2–3	—	Historical average reduction in deficits under socially just consolidations
Adaptation spending	2.5	0.01–15	Very wide dispersion; higher in vulnerable/low-income countries
Mitigation spending	1.4	0.01–6.5	Depends on sectoral focus and policy mix
Total climate fiscal needs (adaptation + mitigation)	~4.0	—	Benchmark for additional annual climate-related outlays
Domestic revenue potential	~2.6	0.03–9.0	From carbon tax/ETS (0.9), wealth tax (0.85), corporate tax reforms (0.85)
International revenue potential	~1.16	0.02–3.0	From aviation/shipping levies (0.58) and FTT (0.58)
Fossil fuel subsidy reform (savings)	~0.5	>1.5 in many emerging markets	Conservative estimate; more possible in energy-intensive economies
Realistic domestic mobilisation	2.0–2.5	—	Assuming partial implementation and political feasibility

Residual financing gap (green debt financing)	1.5–2.0	—	Required annually, on top of primary balance effort to stabilise legacy debt

Source: Author

Therefore, a transition towards adaptive fiscal policy must rest on three key pillars: credibility, flexibility and coordination.

- **Credibility requires that financial market scepticism is met head-on.** Markets may initially view climate-related fiscal expansions as risky, fearing that green investment could become a pretext for broader fiscal loosening or might generate uncertain returns. To counter this, governments must adopt dual-budget frameworks that transparently separate traditional fiscal accounts from green investment spending. Green expenditures should be linked to time-bound, outcome-based performance metrics — such as emissions reduction, resilience enhancement, or productivity gains — and be subjected to independent verification and audits. Independent green investment councils or fiscal watchdogs can further enhance credibility by assessing project quality and fiscal impact before approval. Clear rules and predictable medium-term plans are essential, as markets often penalise fiscal unpredictability more than high debt levels per se.

- **Flexibility must be introduced in fiscal rules and debt sustainability frameworks.** Traditional numerical thresholds (such as 60% debt-to-GDP or 3% deficit limits) risk becoming procyclical and counterproductive in a climate-constrained world. Revised rules could allow for green investment carve-outs, conditional on robust cost–benefit analysis and medium-term debt stabilisation paths. Scenario-based models that show how front-loaded green investment leads to higher long-run growth and lower climate-related fiscal risks can help shift the narrative with credit rating agencies and market participants.

- **Coordination is essential across policies and borders.** Domestically, fiscal and monetary authorities must jointly assess climate-related macroeconomic scenarios to avoid unintentional contractionary effects. Internationally, Ministries of Finance must collaborate through coalitions of the willing, multilateral platforms and IFIs to set credible standards for climate-aligned fiscal governance and access new sources of concessional or blended finance.

To illustrate the outcomes of this paper's proposals, we conduct a stylised and mechanical simulation of debt dynamics according to the assumptions of the previous sections. Our starting points are:

(1) Debt-to-GDP ratio of 100% in 2025

(2) GDP growth at 2% p.a.

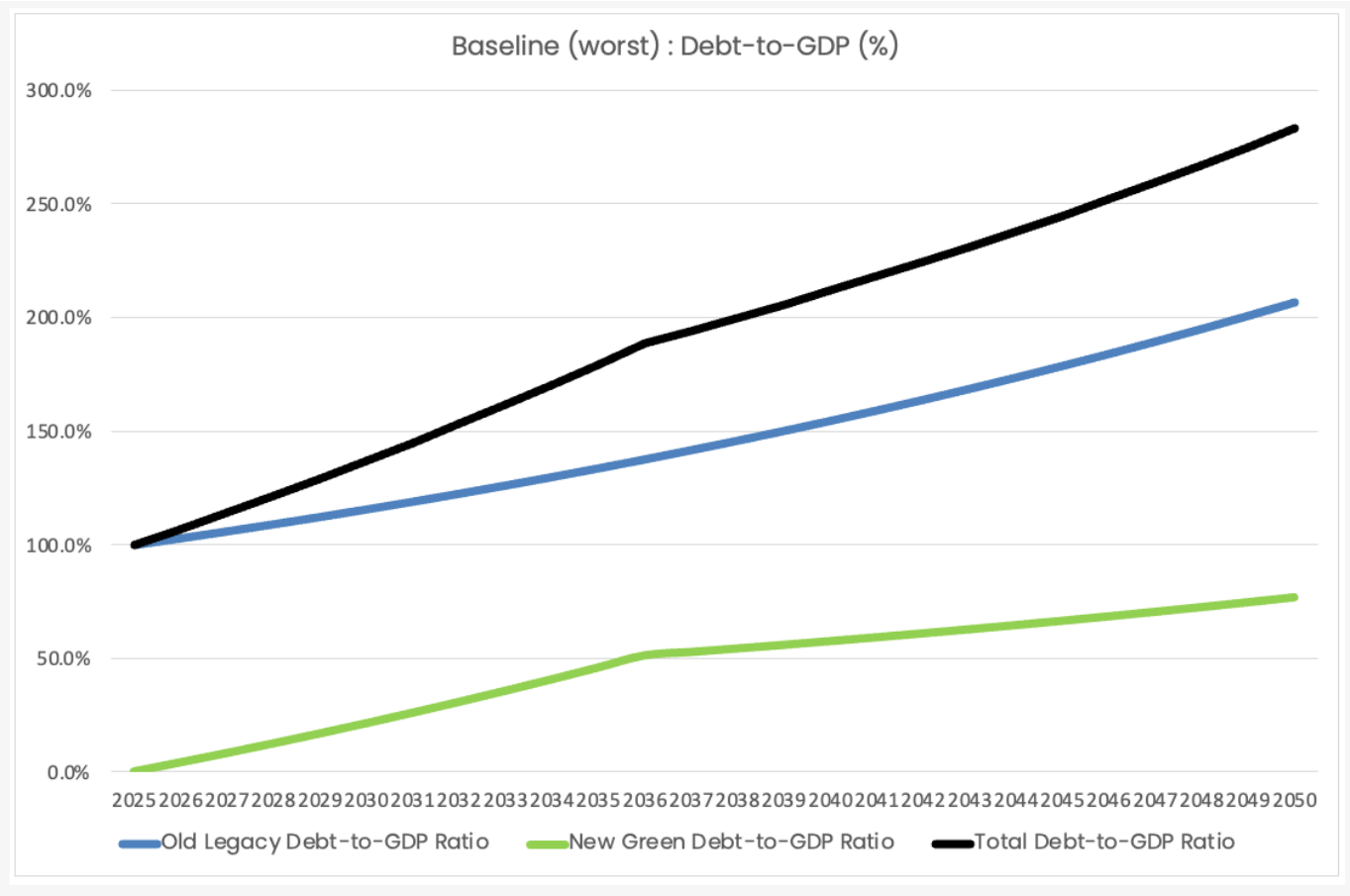
(3) Interest rate of 5%

(4) Total financing needs for climate mitigation and adaptation at 4% of GDP over a decade (2026–2036)

We separate legacy debt from new debt, but both categories are financed under the same market conditions. These parameters allow us to observe the evolution of the total debt-to-GDP ratio from 2026 to 2050.

In a baseline (and worst case) scenario, there is no climate policy and no fiscal consolidation of legacy debt. Additional spending takes place on top of existing trends. The results are shown in Figure V.1.

Figure V.1. Debt dynamics in the baseline (worst case) scenario



Source: Author

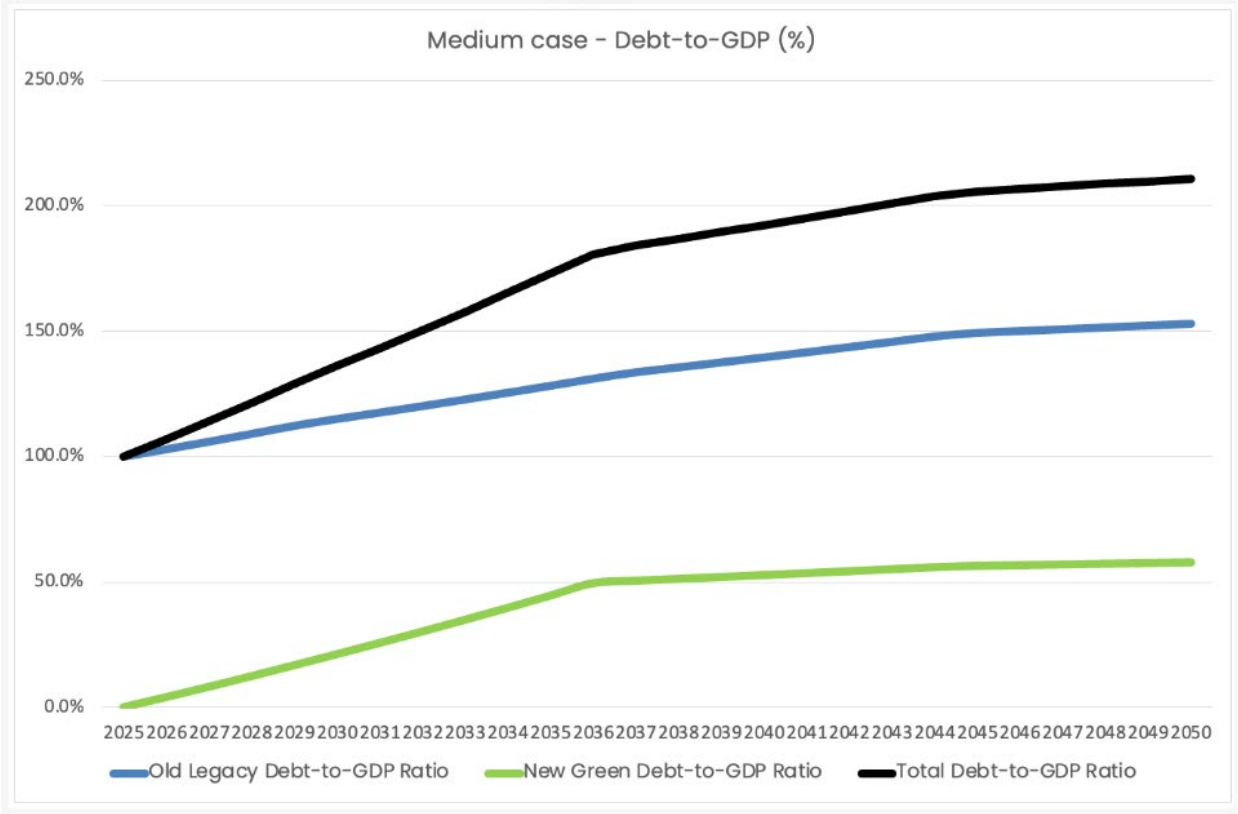
The results clearly show an unsustainable outcome. The debt-to-GDP path is obviously explosive, not only because of the rise in legacy debt, but compounded by the additional spending on climate policies, which produces a snowball effect. Even without any deterioration in risk premia for either debt category — an unlikely assumption — total debt-to-GDP surpasses 280% by 2050.

In the more favourable medium-case scenario, climate spending still occurs but there is no fiscal consolidation of legacy debt. However, additional climate investment eventually produces a moderate growth effect: +0.5 pp annually from 2037 onwards, and an additional +0.5 pp after 2045. The results are shown in Figure V.2.

Here, the outcome in somewhat improved due to the growth effect. Debt-to-GDP stabilises but at a high level above 200% of GDP, a situation that would not represent stability for financial markets. What drives this scenario is simply the multiplier effect of climate spending on growth, rather than structural consolidation.

Finally, in the adaptive fiscal (best case) scenario, the framework proposed in this paper, there is climate spending with fiscal consolidation of both legacy and new debt. The same additional climate spending takes place over a decade (2026–2036) but is then followed by the revenue measures described in this paper (reduction of fossil fuel subsidies, carbon taxation, some benefits coming from international taxation, etc.). These proceeds amount to about 1% of GDP from 2037 and 2% after 2045.

Figure V.2. Debt dynamics in a more favourable scenario (medium case)



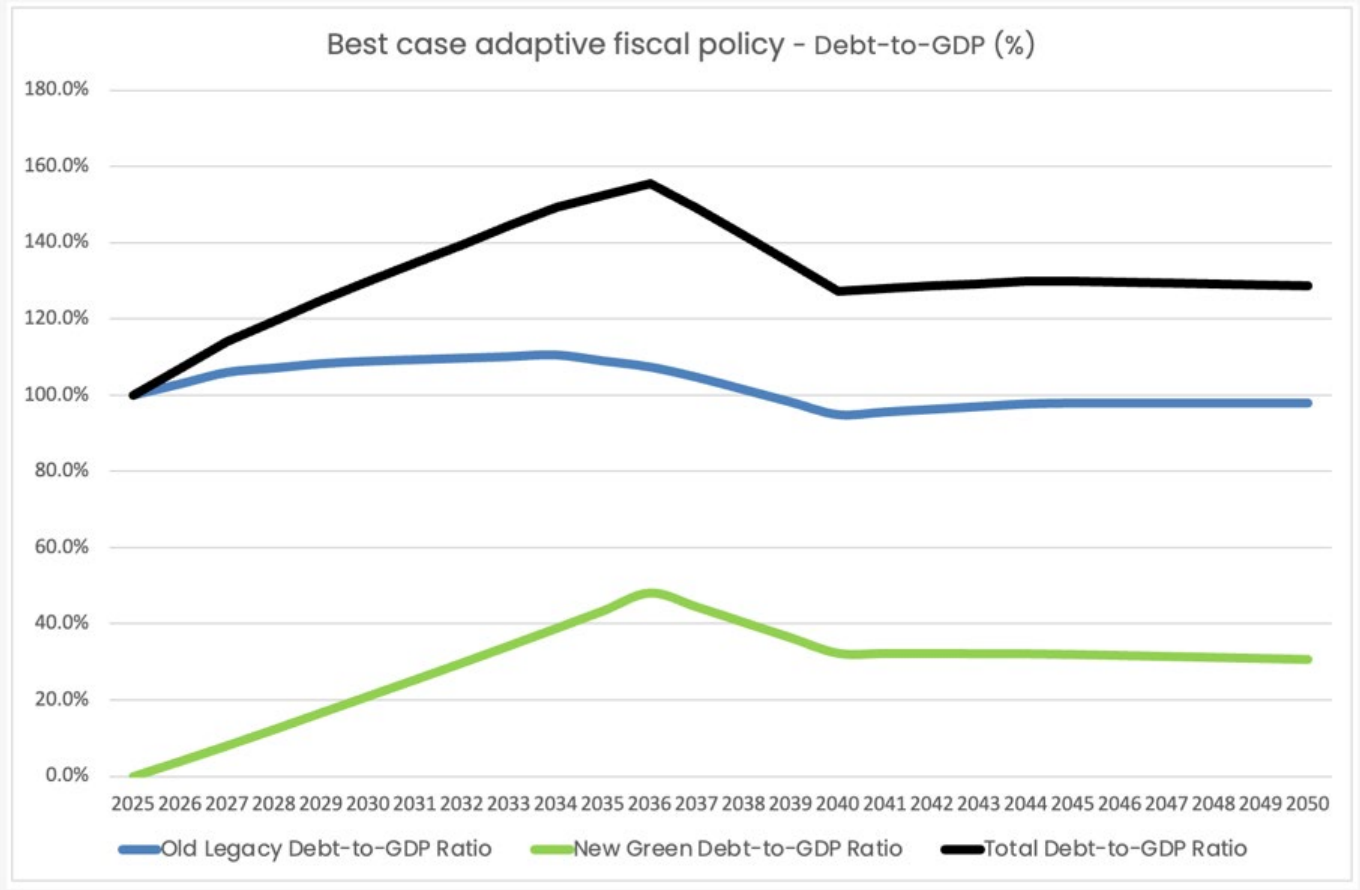
Source: Author

In addition, socially fair fiscal consolidation of legacy debt takes place, in line with our previous discussion, with revenue and expenditure measures of about 1% of GDP each from 2028 and 2% after 2035. Under these circumstances, there is also a positive effect on growth and interest rates. GDP growth accelerates +0.5% from 2037 onwards and +0.25% after 2045 to hover at 3% p.a. at the end of the period. Interest rates also reflect this trend, and decline by 100 bps in 2037 and another 50 bps after 2045. Although these new assumptions are reasonable, they can obviously be made even more optimistic. However, they are sufficient to bring about a stabilisation of total debt-to-GDP after the 'debt hump' in the period 2030–2040 that is alluded to throughout this paper. After that, debt-to-GDP stabilises and falls, with legacy debt coming back to its original 100% figure and new 'green' debt stabilising at around 30% of GDP and then falling. The results are shown in Figure V.3.

The numerical architecture of the simulations is derived from the estimated climate investment needs of roughly 4% of GDP annually, while realistic domestic revenue mobilisation of 2–2.5% of GDP leaves a residual of 1.5–2% for green debt financing. The legacy debt consolidation path of 2–3% of GDP corresponds to a socially acceptable fiscal consolidation, based on existing proposals for revenue and expenditure adjustments. Then the stabilisation requirements derived from improved growth and lower risk premia in the adaptive scenario reduce the needed primary surplus to about 1.5–2%.

These assumptions together generate debt dynamics that match the qualitative outcomes: explosive debt in the baseline, high but stabilising debt in the medium-growth scenario and stable or declining debt-to-GDP in the adaptive fiscal framework after the 2030–2040 hump. Overall, the investment needs, fiscal efforts, revenue assumptions and resulting debt trajectories are grounded in the standard debt dynamics identity. Table Conclusion 1 summarises these results.

Figure V.3. Debt dynamics in the adaptive fiscal policy (best case) scenario



Source: Author

Table V2. Debt dynamics in the three scenarios

Worst case	2026–2035	2.0%	5.0%	0.0%	-4.0%	119%	26%	146%
	2036–2045	2.0%	5.0%	0.0%	-0.4%	157%	58%	216%
	2046–2050	2.0%	5.0%	0.0%	0.0%	195%	72%	267%
Medium case	2026–2035	2.2%	4.7%	0.0%	-4.0%	117%	26%	143%
	2036–2045	2.8%	4.2%	0.0%	-0.4%	141%	53%	194%
	2046–2050	3.3%	3.8%	0.0%	0.0%	152%	57%	209%
Best case	2026–2035	2.2%	4.7%	2.0%	-4.0%	109%	26%	134%
	2036–2045	2.7%	3.6%	2.0%	1.2%	99%	36%	135%
	2046–2050	3.0%	3.0%	0.0%	0.0%	98%	31%	129%

Source: Author

The macroeconomic logic underpinning the adaptive fiscal framework rests on five mutually reinforcing mechanisms. First, it recognises an unavoidable political economy constraint. In most countries, traditional taxation alone cannot stabilise both legacy and climate-related debt, implying that a temporary rise in public debt — the green hump — must be accepted as an intergenerational investment whose benefits in resilience, avoided losses and long-term productivity justify a higher transitional debt path. Second, the framework introduces a transparent dual-account system separating legacy budgets from green investment accounts, giving markets full visibility for which liabilities finance consumption and which finance growth-enhancing, risk-reducing assets. This transparency is essential for restoring predictability and strengthening market confidence in long-run debt sustainability. Third, it builds on a realistic trajectory for future domestic revenue mobilisation, particularly through climate-related taxes and subsidy reforms that can become politically and socially acceptable when framed as part of a fair and credible transition. Fourth, it incorporates growing evidence that resilient, climate-prepared economies face lower sovereign risk premia, allowing reductions in borrowing costs that materially improve debt dynamics. Finally, it embeds the positive growth effects associated with climate investment via standard supply-side multipliers, crowd-in channels and resilience gains, reducing the interest growth gap and making debt stabilisation achievable under plausible macroeconomic conditions.

In sum, adaptive fiscal policy is not a licence for fiscal laxity. It is a disciplined, transparent and forward-looking framework for managing the defining macroeconomic and geopolitical challenge of the 21st century. Done well, it will become a structural reform of the state; one that reshapes fiscal institutions, embeds long-term climate goals into budgetary processes and ensures that every euro of climate spending generates measurable resilience and productivity gains. Rather than widening deficits indiscriminately, adaptive fiscal policy differentiates between consumption and investment, between legacy liabilities and future-building assets, and between short-term pressures and long-term national interest.

Such an approach can transform climate risk from a destabilising force into a catalyst for climate-resilient development. By publishing transparent multi-year investment pipelines, ring-fencing green budgets and linking disbursements to verifiable outcomes, governments reduce uncertainty and allow financial markets to price the transition rationally rather than fear it. Credibility will require rigour, innovation and clear communication, but above all a coherent commitment to high-quality, independently verified climate investment.

If countries succeed in this transformation, the payoff is profound: a fiscal architecture capable of absorbing shocks rather than amplifying them; a macroeconomic strategy that restores trust between governments, markets and citizens; and an investment pathway that accelerates the transition to a safer, more equitable and more prosperous world. The challenge is immense, but the opportunity is greater still. The true risk is not doing too much: it is doing too little, too late. Adaptive fiscal policy offers a path forward that matches the scale of the moment.

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