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Research Article

On Debt and climate

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Abstract

This article discusses the links between climate and debt sustainability by focusing on how climate mitigation and adaptation are paid for, and who pays for it. This requires thinking about instruments such as sovereign bonds, carbon credits, conditional official grants and debt relief from both public and private sources. The article discusses the role of green bonds, carbon offsets, grants and debt relief. Among these solutions, no single instrument appears to be right for all countries or at all times. To move forward, we make six proposals and policy recommendations that can jointly address climate change and debt sustainability.

Keywords: climate change, debt sustainability, debt relief, carbon offsets, green bonds

INTRODUCTION

Any discussion of the links between climate change and public debt should start with the five basic numbers: 270, 42, 6.4, 2400 and 60.

The first is the remaining carbon budget in gigatons (Gt) if the goal of keeping average temperature rise to below 1.5°C is to be reached with high likelihood; the second refers to the current global emissions of CO_2 (also in Gt); the third is the ratio of the first number (a stock) and the second number (a flow), which tells us how long it will take, in years, to 'spend' the remaining carbon budget; the fourth is the amount of cumulative historical emissions since 1850; the last number is the share of low-income economies (under the International Monetary Fund and the World Bank classification) that are currently either in debt distress or at high risk of debt distress.

Framing the problem in terms of the carbon budget illustrates that climate change is a *stock* and not a *flow* problem. Each additional emitted unit of CO_2 stays in the atmosphere for decades and, at current emission levels, the carbon budget will be exhausted by June 2029. If one raises the temperature limit to 2°C one could allow for a larger budget of about 1000 Gt, which gives us 18 extra years (up to 2047). However, there is a significantly larger risk of tipping points from raising the temperature limit (Lenton et al., 2019).

Investment in climate change mitigation and adaptation is likely to pass any cost–benefit analysis. Nevertheless, such investment is costly and requires financing. Hence, addressing climate change involves difficult trade-offs and challenges, such as the need to balance economic development and energy access with the need to reduce greenhouse gas emissions.

Given that climate change affects people across generations, part of this financing needs to come in the form of debt, which allows for the distribution of the financial burden of climate expenditure across generations. However, there are complicated questions related to the link between climate and debt: (i) How much debt creation does climate action justify? (ii) Can climate sustainability and debt sustainability be reconciled? And (iii) how should debt instruments be designed to best support climate change? Things become more complicated when we recognize that carbon emissions generate global externalities and that countries have different interests and resource limitations. These considerations illustrate the additional challenge related to aligning individual country interests with the global interest of limiting temperature rises and show that walking the path to net zero will require international cooperation and coordination, political will and exceptional leadership.

This paper is based on a report by Bolton *et al.* (2022a) that explores different links between climate and debt and proposes a set of six policies for addressing climate change while maintaining debt sustainability. We start with four perspectives, or 'lenses,' through which to view the global climate change challenge: (i) limiting global average temperature rise (mitigation); (ii) limiting local effects of climate change (adaptation); (iii) providing conservation services; and (iv) achieving climate equity.

Mitigation relates to the carbon budget discussed above and to the need to reduce CO_2 emissions. As mentioned, we face a stock and not a flow problem. Even if we were able to immediately stop emissions, we would still face the consequences of climate change for centuries to come because the CO_2 already in the atmosphere

[1] The carbon numbers are based on the IPPC 2021 report, which put the remaining carbon budget in 2020 at 300 Gt for an 83% probability of remaining below 1.5 warming. For a discussion of the share of countries that are either in debt distress or at high risk of debt distress, see https://www.imf.org/en/News/Articles/2023/04/06/sp040623-SM23-CurtainRaiser.

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will stay there for decades or centuries, and every extra ton of CO_2 will add to this stock. This is why time is of the essence and it is also why investment in adaptation is necessary. The globe has already warmed by around 1.1°C above pre-industrial levels. As a result, the severity of climate-related calamities will keep worsening. Although climate change is happening at the planetary scale, the distribution of past and present emissions is anything but equal and neither are their consequences. Vulnerability to climate change tends to be higher for emerging and developing economies. These are the countries that need to invest the most in climate adaptation but are also the countries that are more likely to lack the resources to do so.

The provision of conservation services includes actions aimed at not releasing carbon from existing carbon sinks (preserving forests, leaving coal and oil and gas in the ground) and actions aimed at increasing the amount of nature-based carbon extraction (reforestation). In both cases, countries that preserve or expand their own carbon sinks provide climate services to the rest of the world and should be compensated for this action (see Adrian *et al.*, 2022 for a proposal that focuses on avoided emissions from phasing out coal). A global carbon market would, in principle, compensate emerging and developing economies for conserving their natural resources. However, currently this market is small and voluntary.

This discussion brings us to the fourth lens, that of equity. The countries with the greatest adaptation needs are generally poor and do not have the resources needed to finance essential adaptation investments. Moreover, rich countries are responsible for most of the CO_2 that is causing climate change and have a moral responsibility toward poorer countries that suffer from the consequences of climate change. It is thus fair that richer countries should make a greater effort in reducing emissions and in compensating, through grants and debt relief, poorer countries that suffer the negative effect of climate change.

Addressing these multiple problems will require scaling up climate finance. By climate finance we refer to transactions that are conditional on climate-related actions or outcomes. Climate finance can take the form of lending instruments such as bonds or loans or non-debt creating transactions such as grants or debt relief. We start with a discussion of lending instruments with a specific focus on green bonds and then move to non-debt creating transactions.

GREEN FINANCIAL INSTRUMENTS

The best known green financial instruments are green bonds. Green bonds tie funds raised to specific green projects and are primarily issued by corporates or municipal issuers. Green bond issuance has increased dramatically over the past decade, and particularly so over the past few years (Curtis et al., 2023). However, it still only represents a small fraction of the global bond market. While there seems to be strong demand for green bonds from investors—especially those with an environmental, social, and governance (ESG) focus—there is little evidence of a significant price advantage for green bonds, as their pricing still largely reflects credit risk and liquidity (Baker et al., 2022). Nonetheless, issuing green bonds can benefit corporations by bolstering their green brand or reputation and attracting more interest from ESG equity investors, potentially leading to a boost in their stock price (Flammer, 2021).

While the signaling benefit of issuing green bonds may benefit corporations, it is less clear why it should benefit sovereigns. As money is fungible and government spending decisions are typically made by a legislative body, green sovereign bonds cannot easily be tied to specific allocations of funds. In fact, Bolton *et al.* (2022a) and Curtis *et al.* (2023) show that sovereign green bond issuers never make credible and legally binding commitments to use the raised funds for green projects. The lack of a signaling benefit and commitment in allocating raised funds to green expenditures raises the question of why sovereigns issue green bonds.

A hotly debated question is whether sovereign issuers of green bonds benefit from a 'greenium' (i.e. lower borrowing costs for green bonds). As with corporate green bond issuances, quantitative research on the presence of a sovereign greenium has produced mixed results. The main challenge in determining the presence or absence of a sovereign greenium is finding conventional government bonds with parameters that are comparable to those of the green bonds issued by the same country. In Bolton *et al.* (2022a), we build a dataset that includes 63 sovereign and sovereign-guaranteed bonds matched with comparable conventional bonds and find a negative greenium of 4.8 basis points (meaning that green bonds have a higher yield than comparable conventional bonds). The penalty is higher in advanced economies and is driven by sovereign-guaranteed issuers and for bonds issued in currencies other than euros or US dollars.

While there is a green penalty for the average bond, we find that there is a statistically significant positive correlation between climate vulnerability and the presence of a greenium. A one standard deviation increase in climate vulnerability exposure is associated with an 11-basis point increase in the greenium. Although these are preliminary results that warrant further investigation, they are in line with the hypothesis that investors value green investment where it is needed the most. We note here also that interviews with market participants suggest an equivalent, if not greater, skepticism about the presence of a real greenium (Curtis et al., 2023). This is not the key consideration driving this market, either on the demand or on the supply side.

There are different ways to understand the absence of a greenium for the average sovereign green bond. One possibility is that fund managers do not care about the green investments that the bonds are supposed to finance (the underlying investors might, but they are too far from decision-making about asset allocation). Another possibility is that investors do care, but that they are not willing to accept a lower yield because the promise to use the proceeds for green investment is not credible. Or it may be that investors care, but the amount they are willing to give up in yield is too miniscule to justify legal credible green promises—thereby leaving this set of promises entirely dependent on reputational sanctions.

In terms of policy implications, it is crucial to distinguish between these two possible explanations for the absence of a greenium. If investors are not genuinely interested in green projects, then green finance is not a reliable tool to promote climate policies, regardless of how the bonds are structured. However, if the reason for the absence of a greenium is lack of trust that the bond proceeds will be used for green projects, then, it may be possible to improve the bond contract to increase investor trust and raise the greenium. In Bolton *et al.* (2022a), we discuss how to build enforceable green bonds that would address this latter problem.[2]

[2] A recent debt for nature swap led to the issuance of by Belize of Blue Bonds with strong legal enforcement (see Bolton *et al.*, 2022b). Unfortunately, these bonds cannot be used to test for the presence of a greenium because there is no conventional comparator.

Even if sovereign green bonds were enforceable, they would still not address the problem that money is fungible. Thus, the funds raised with green bonds could finance investments that would have been financed even without the issuance of green bonds. In other words, green bonds may not lead to additional green investment. A solution to this problem, popular in policy circles, relates to the use of sustainability-linked bonds (SLBs).

SLBs link financial returns to the issuer's performance on sustainability targets. They differ from green bonds as they tie debt-servicing terms to achieving specific environmental impact targets without any focus on the specific use of funds. Rather, they use payment terms as an incentive to achieve environmental goals and include a mechanism for reporting and verifying impact performance.

SLB can, in theory, appeal to a broader range of issuers, including those who may not have identifiable green projects or initiatives. Flexibility for issuers to define the specific sustainability metrics that will be used can be a strength of the instrument, as it allows issuers to tailor the targets to their specific needs and circumstances. However, it also raises concerns about the potential of using vague or weak targets that may not actually result in meaningful sustainability improvements. The challenge lies in designing a verification mechanism that is credible and not subject to manipulation. The existing verification mechanisms for sovereign sustainability bonds have not been effective, but with proper monitoring and verification, these bonds could encourage sovereigns to act toward environmental protection. Flugge *et al.* (2021) present a detailed discussion of a credible and enforceable framework for designing and assessing SLB and screen existing data that allow to identify potential key performance indicator that a sovereign can use for setting enforceable targets for sovereign SLB.

As of this writing, the markets have shown relatively little enthusiasm for the various versions of SLBs, tending to prefer more traditional 'use of proceeds' green bonds. This may reflect the general reluctance of fixed income investors to touch what look like contingent instruments, or it may be that the market is in its infancy. There has also been talk of incorporating climate resiliency clauses in more traditional bonds in particular for climate vulnerable nations (Butler et al., 2023). But again, this has not caught on. The NextGenerationEU program provides an ideal opportunity for kick-starting the market of sovereign sustainability, and Lehmann & Martins (2023) discuss the benefits of such a policy and outline a possible design for a single European Union (EU)-wide framework for the issuance of sovereign SLBs.

GRANTS AND ENVIRONMENTALLY FRIENDLY DEBT RESTRUCTURING

A series of negative economic shocks that started with the explosion of the housing bubble in the United States and then continued with the Covid pandemic and the current Russian invasion of Ukraine have brought public debt to historically high levels. Higher interest rates in the advanced economies and tighter financial conditions are pushing many of emerging and developing countries to the brink of debt distress. Climate change makes the situation worse, as countries face increased costs associated with mitigation and adaptation measures. In addition, climate change may also lead to increased economic volatility, which could further increase the risk of debt distress.

Volz *et al.* (2020a) highlight six possible channels through which climate change can affect sovereign spreads. They include impact on natural capital, climate-related natural disasters, adaptation and mitigation expenditure, financial crises associated with the presence of stranded assets, reduction in trade and political instability. These channels are consistent with the finding that exposure to climate risk leads to a significant increase in borrowing costs (Kling *et al.*, 2018; Bolton *et al.*, 2022a). This situation can lead to a vicious circle in which the reduced fiscal space brought about by higher borrowing costs leads to lower adaptation investment, which, in turn, will lead to higher climate vulnerability and even higher borrowing costs (Buhr et al., 2018).

Estimates of the fiscal costs of adapting to climate change are fraught with uncertainty, but the available data suggest that upgrading public infrastructure and coastal protection will cost an average of 1.2% and 0.1% of GDP annually for emerging economies, respectively, and much more for small developing states (Chamon et al., 2022).

These estimates suggest that climate-friendly financial instruments will not be enough to finance the needed investment on both mitigation and adaptation. Many countries, including the most vulnerable island countries, may not have enough fiscal space to cover the costs of climate-related expenditure, period. Even with fiscal adjustments and economic reforms, they will need international fiscal support for economically efficient adaptation investment.

The question is how this fiscal support should be delivered. Should it take the form of grants or debt relief? And if the answer is debt relief, how should relief be designed for maximum impact on climate objectives?

Grants mostly come from official sources, such as bilateral or multilateral organizations, and Non-Government Organisations (NGOs). While the volume of climate-linked grants is smaller than debt financing, it is not insignificant, with official climate-related grants totaling $16.7 billion in 2019 (OECD, 2021). The importance of grants has also been recognized at the 27th Conference of Parties (COP 27), which took place in Egypt in November 2022. The agreement of providing 'loss and damages' funding for countries hit by climate disasters recognizes is an explicit recognition that any equitable solution for addressing climate change will require large transfers from rich to poorer countries. It is also because countries need to be compensated for climate events that have large impact on their public finances and funding costs (Buhr *et al.*, 2018; Volz *et al.*, 2020b).

Debt relief can take two forms. The first is debt restructuring in response to debt distress. Debt restructuring aims to restore debt sustainability while minimizing losses for creditors. Debt restructuring can increase fiscal space for public investment, but it is not usually conditional on specific spending commitments by the debtor. However, as private capital mobilization is difficult for countries at high risk of debt distress, debt relief could have a positive direct effect on private climate finance, which accounts for about 50% of climate finance (Naran et al., 2022).

The second form of debt relief is a 'debt-for-something' swap. With this type of debt relief, creditors agree to reduce a debt claim in exchange for a commitment from the debtor country to fund a specific project or initiative, such as nature conservation. Debt swaps can happen in both distressed and non-distressed debt situations. Unlike debt restructurings, many debt swaps are voluntary, meaning that the alternative to agreeing to the swap could be paying back the full amount owed.

In a simple debt swap operation, an official creditor may forgive outstanding debt on the condition that part of the original debt service is used for conservation or sustainable development purposes. Another type of debt swap, known as a trilateral debt swap, involves the purchase of commercial debt at a discount by

a third party (usually a non-profit NGO), which is then swapped for a commitment to fund conservation projects. There have been around 90 bilateral and 50 trilateral debt-for-nature swaps since 1987. However, the total volume of debt swapped has been small, well below $5 billion, compared with more than $1 trillion of standard debt restructurings. One key characteristic of debt swaps is that they usually involve a subset of creditors (often small) and are thus not 'comprehensive.' This is especially problematic for countries with debt sustainability problems because the swap may bail out non-participating creditors.

It is also possible to think of a form of debt relief that falls between debt swaps and conventional debt restructurings. This would involve a comprehensive restructuring contingent on policy measures and spending commitments (such as climate adaptation) like those envisaged by debt-for-climate swaps (see Volz *et al.*, 2020a).

According to Chamon *et al.* (2022), fiscal support should be targeted to the specific problem that needs to be addressed, but in general grants dominate debt relief. If the objective is solely to create fiscal space for climate investment, climate-conditional grants are the best option because they ensure that the full amount of the grant is used for its intended purpose. Debt relief provides fiscal support by reducing debt. While this can free up resources for climate investment, this is not always specifically targeted. Moreover, the climate expenditure commitment that could be tied to debt relief is risky because the country could enter a new debt crisis. Thus, even in the presence of debt sustainability problems, the combination of traditional debt restructuring and a separate climate-conditional grant could be superior to a debt-for-climate swap because the grant component makes the climate commitment senior to debt service.

There are, however, two conditions under which climate-conditional debt restructuring is justified. The first has to do with politics. Grants may simply not be available and climate-conditional debt restructuring may be the only viable approach to provide support for climate-friendly expenditure.

The second condition relates to situations in which the debtor's climate actions have a significant impact on its creditworthiness. In this case, there is an efficiency argument for linking climate action and debt relief. If climate adaptation investments reduce the risk of future debt crises in climate-vulnerable countries, it is in the best interests of all creditors to require climate adaptation as a condition for debt restructuring. In Bolton *et al.* (2022a), we show that climate-related events that cause damages equal to 1% of GDP are significantly associated with an increase in the fiscal deficit, especially in emerging and developing economies. The link between climate risk and debt risks supports comprehensive climate-conditional debt relief, rather than just debt swaps involving only one creditor or class of creditors.[3]

CARBON OFFSETS

Carbon offsets, which involve paying for emission reductions in one place to offset emissions elsewhere, have the potential to not only reduce the cost of emission reductions, but also to provide a valuable source of finance for developing economies and incentivize private investment in emission reductions.

[3] There are cases, however, in which a debt swap may dominate a combination of conditional grants and comprehensive debt restructurings. This is when comprehensive debt restructurings are costlier than a debt swap that deals with a more limited debt perimeter. For instance, if creditors participating in the debt swap do so voluntarily, the swap may not have any reputational implications. The 2021 Belize restructuring operation offers an example (see Bolton *et al.*, 2022b).

Carbon credits are key to achieve net zero because certain economic activities will continue to emit carbon. Some sectors can decarbonize more quickly than others can, so allowing these sectors to sell carbon credits can encourage them to reduce emissions faster. Even if the global economy could entirely eliminate carbon emissions, there is already so much carbon dioxide in the atmosphere that large-scale carbon capture and sequestration will still generate significant mitigation benefits. It is however necessary to move beyond voluntary carbon credits.

To understand the financial potential of carbon offset markets, consider the revenue generated by the European Union from selling carbon emission allowances through the EU Emissions Trading System (EU ETS). Over 2020–2022, the estimated total revenue from these auctions have exceeded €15 billion per year. Currently, the supply of allowances comes from unused allowances from companies emitting below their quota and allowances auctioned off by the EU ETS. However, there is no need to limit the supply of allowances to these two sources, as any carbon emission reduction anywhere in the world can be used to offset emissions that exceed a given quota, with the same overall effect on global emissions. Moreover, there is no reason to restrict who can buy EU ETS allowances, as they could also be used as voluntary offsets for emissions outside the European Union. Any buyers outside the EU ETS would increase the price of allowances, bringing the price of EU allowances closer to the social cost of carbon. This means that the ETS markets could be integrated with voluntary carbon credit markets to create a functional and scalable global carbon offset market. Economists have advocated for a global carbon tax, as carbon emissions are a global externality. An integrated global carbon offset market would bring us closer to this goal, while also providing permanent financial flows from rich countries to poor countries for preserving nature-based carbon sinks and funding emission reduction projects and sustainable development.

For a global carbon offset market to be possible, two key conditions must be met. Firstly, carbon offsets must be completely trustworthy and credible, which requires a whole infrastructure to verify, register, monitor, audit, standardize and prevent double counting of carbon credits. Secondly, comprehensive *mandatory* decarbonization must be accelerated and properly enforced, which will increase the demand for offsets and raise their price, creating its own supply. When a deep global market for offsets exists, it will remove a major obstacle to decarbonization. All companies in all sectors will be in the same position of being able to fulfill their net decarbonization obligations by either directly decarbonizing or purchasing offsets. If the cost of direct carbon reductions is too high, a company can buy offsets instead. Conversely, if the cost is lower, a company can not only reduce emissions directly but also exceed its net carbon reduction obligations and sell the excess as a carbon credit.

The world has been slow to reduce its reliance on fossil fuels and transition to decarbonization. This is partly due to companies claiming that direct emission reduction is either impossible or too expensive in the short term. As a result, regulators have often delayed or weakened carbon emission regulations, which has both emboldened business groups and undermined the credibility of decarbonization policies. If a robust carbon offset market were in place, companies would no longer be able to use these excuses to avoid reducing emissions. Instead, they could meet their decarbonization targets by purchasing carbon offsets. Of course, to make this approach effective, all economic activities that emit carbon should be required to decarbonize on a net basis, and all companies operating in the same sector should be held to the same net decarbonization requirements to ensure a level playing field.

By providing a stable and predictable source of finance, a large carbon credit market would create an attractive investment environment for private actors, who could earn returns by investing in emission reductions projects in developing economies.

CONCLUSIONS

Addressing climate change while maintaining debt sustainability requires multiple instruments and actions as there is no single instrument and policy that is right for all countries or at all times. It is also hard to predict which solutions will receive political and market buy-in.

We propose six main policy recommendations:

1) *Develop a clear legal framework and verification mechanisms that will enhance the credibility of green sovereign bonds.* The current state of green bonds, and their various variants, may not be resulting in meaningful climate change because the instruments promise little that is legally enforceable. It is possible that reputational sanctions are working to ensure compliance, but there is no evidence that issuers who cannot be trusted to repay principal and interest without the threat of legal sanctions can be trusted to comply with vague promises to improve climate conditions. We suggest addressing this issue by developing bonds with concrete and legally enforceable green promises.
2) *Set up a climate information and monitoring system to support the development of sustainability-linked sovereign bonds.* Traditional green bonds do not allow for experimentation or innovation. SLBs are more flexible and incentive compatible. Multilateral development banks and NGOs can help develop the SLB market by contributing to their design and by monitoring performance indicators.[4] Climate resilience debt clauses may also have potential. So far though, none of this has received adequate market buy-in and that needs to be focused on.
3) *Create an institutional framework for a carbon credit market based on mandatory direct and indirect carbon emission reduction requirements for all large emitters.* A well-working global carbon market could generate substantial flows from rich to poor countries and help monetize the natural assets that these countries hold. However, this will not happen as long as the market for carbon credit remains fragmented and voluntary.
4) *Integrate 'cap and trade' markets with the voluntary carbon market*: For instance, the EU ETS market could be expanded so it can also be used as voluntary offsets for emissions outside the European Union. This means that the EU ETS markets could be integrated with voluntary carbon credit markets to create a functional and scalable global carbon offset market.
5) *Commit to an annual target for fiscal support for adaptation, mitigation and transition expenditures in developing and emerging market countries.* Public investment costs for adaptation in emerging markets and developing economies are estimated to be in the order of US$500 billion per year. Advanced and high-emitting upper middle-income countries will need to provide fiscal support at least for the countries whose mitigation and adaptation costs exceed their fiscal capacity, and they should go beyond this minimum on fairness grounds.[5]
6) *Improve the design of debt-for-nature swaps. Debt–nature swaps could be linked to budgetary spending categories or climate performance commitments.* They should rely either on negotiated debt exchange offers backed by collective action clauses or donor-conducted debt buybacks.[6] The structure of debt-nature swaps needs to ensure that climate or conservation-related expenditure commitments are honored even if the debtor is forced to restructure its commercial debt. Right now, these deals look expensive to do, relative to the climate payoffs that they generate. But there could be potential for improvement.
7) *Include climate conditionality in comprehensive debt restructurings addressing unsustainable debt.* Future debt restructurings should be based on debt sustainability analyses that explicitly accounts for the fiscal costs of climate-related expenditures and include enforceable climate conditionality.[7] One way to achieve this objective is by exchanging the conventional bonds that are being restructured with appropriately defined SLBs.

Implementation of these policies requires political determination and international coordination, not just in the advanced economies that are responsible for most of the existing stock of CO_2, but also in the developing economies that must leapfrog to a low-carbon development model.

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[4] For a discussion, see Flugge *et al.* (2021).

[5] It is worth nothing that at COP 15 in 2009, the advanced economies committed to mobilize $100 billion per year by 2020 and have not yet delivered on this commitment.

[6] We envision negotiated buybacks backed by CACs only during credit events in which the country needs a comprehensive restructuring and hence is already rated as being in selective default.

[7] This is in line with what was suggested by Volz *et al.* (2020b).

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